From individual to supply chain: the role of performance measurement

by

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in partial fulfilment of the requirements for the degree of

Master of Science

in Operations Management and Logistics

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Tjebbe Nabuurs
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

TUE. School of Industrial Engineering.
Series Master Theses Operations Management and Logistics

Subject headings: supply chain management, performance measurement system, transport, warehousing, strategy framework
Preface

This report concludes my graduation project of my master Operations Management. It furthermore concludes my time at the Eindhoven University of Technology, which has been a big part of my life for the last six years. In these years I have learnt a lot, both about myself as about the world around me. And I have the lecturers and my fellow students to thank for that, but off course also the University to provide me with the opportunity to meet these people in the Netherlands and abroad in South Africa during my international semester.

But I also want to thank some people in particular, especially for their help during my graduation. First of all I would like to thank Tom van Woensel, for supervising and mentoring me during this last part of my master. Thank you for bringing me in contact with Tjebbe Nabuurs which has provided me a wonderful place and project to conduct this research. Furthermore I would like to thank you for the numerous occasions in which you were able to assist me in finding the core of this research and the valuable and clear feedback you were always able to give. I have learned a lot from you and your vision on the broad area of operations management and logistics. And you have even made me consider pursuing a job as lecturer to share knowledge with future generations. I would furthermore like to thank my second supervisor Ton de Kok for sharing your knowledge, and your contagious enthusiasm and ambition towards logistics.

Secondly I would like to thank my supervisors, colleagues and interviewees at Nabuurs, Partner Logistics, and Unilever. Thanks Tjebbe Nabuurs, for providing me with the opportunity to perform such an interesting boundary spanning research and the feedback and visions you shared with me. And thanks Joop de Hoog for the endless conversations in the car to and from Westerlo. The discussions have provided me with a lot of knowledge regarding practice but also regarding myself and my ambitions. Remember to invite me to your party if your still working at your 75th birthday, I envy your work spirit. I also want to thank Duco Buijze for the professional and personal guidance during my internship at Partner Logistics, and off course for the opportunity to act as your driver in the Jaguar. Finally I would like to thank Eelco Schnabel for the numerous discussions and feedback that you have provided me with these past months. It has been a pleasure working with you and learning from you. And I hope you did not get any tickets for the numerous times you rushed me to the train station.

Last but certainly not least I would like to thank all of my friends and family for their support in the final stretch of my study, giving feedback but also time for relaxation. My goldfish Donald and blue finfish Boris for keeping me company during the endless days of typing this report. Finally I would like to mention my grandma which passed away during this research. I would love to share this special moment in my life with you but I know you are proud of me and that you will be sitting in the best seat during my graduation.

Daan Meboer

Eindhoven, August 2013
Abstract

The area of supply chain management is still fairly ambiguous and unexplored, especially the practical application of supply chain management framework and models developed by researchers. A literature study resulted in the development of a number of concepts and implications regarding supply chain management, as for example the identification of a supply chain as a service and the existence of sub-supply chains. This master thesis develops a strategic framework and associated performance measurement system on the basis of supply chain management and performance measurement literature to investigate the importance of performance measurement for supply chain management. This framework is then validated and used to analyze the business case supply chain of Nabuurs, Partner Logistics and Unilever. This results in a general supply chain approach and a specific recommendation for the supply chain under investigation.

The keywords of this report are depicted below in a “wordle” based upon a word count:
Management summary

This master thesis is the result of a six month internship on behalf of Tjebbe Nabuurs of Nabuurs supply chain solutions. The assignment was to identify the implications of efficient supply chain management (SCM) and especially the practical issues associated with the integral implementation of SCM.

In the logistics service provider sector the margins are getting smaller and smaller which compels logistic providers to join forces. This research has been initiated by Nabuurs in order to identify and exploit the implications of SCM in general and specifically for the frozen supply chain of Unilever of which they are part. SCM has been depicted as the management of the physical, information and financial flow from the raw materials to the customer. However the exact definition of SCM is still ambiguous and the term SCM is still widely used for practices that do not share the integral perspective of SCM. Therefore this research aims to provide a link between the scientific SCM literature that is available and a business environment.

One of the first insights that this research has put forward is the identification of a supply chain as a service, the production and delivery of a product to the end customer of the supply chain. The identification of a supply chain as a service has a number of implications for the scientific area of SCM. First, services are context specific for the customer and are therefore highly customer oriented. Secondly, services cannot be stocked and therefore need to be managed in a specific way to make sure that the demand can be met. Thirdly, it enables SCM researchers to use models and frameworks developed for service improvement practices. The SERVQUAL model is one of the service frameworks which have been extensively used throughout this research. The SERVQUAL model identifies a number of gaps that need to be addressed to reduce the gap between the perceived and expected service of the end customer.

As stated customer orientation is crucial for the strategic intent of the supply chain as an integral entity. However the distinction of the end customer is very ambiguous. The introduction of the customer order decoupling point (CODP) in SCM has resulted in the introduction of the leagile principle. The leagile principle divides the supply chain in an up- and downstream part of the supply chain at the CODP. The upstream part of the supply chain employs a lean perspective while the downstream part towards the customer is focused on agility. In my opinion this division is a bit to ambiguous and simple. I therefore introduced the concept of sub-supply chains. Each supply chain is divided up into a number of sub-supply chains which is comprised of a minimum of three parties, as depicted in the definition of a supply chain, including a customer. This is in line with the existence of multiple order decoupling points and the change of strategy at the transition from make-to-stock towards make-to-order principles. Using this concept each sub-supply chain may follow a different strategy in line with the customer’s expectations as the CODP depicts a transition point from one end customer to another. These insights have led to an improvement to the definition of supply chain management that has been researched and depicted in the literature study that has been executed prior to this master thesis.

“Management, planning, and development of inter- and intra-organizational processes and information and financial flows aimed at coordination and collaboration between (sub)supply chain partners to fulfill the (sub)supply chain’s end-customer expectations as efficient as possible.”

SCM however is still a very broad research area. In the literature study that is executed prior to this master thesis performance measurement has been identified as a very interesting subject within SCM. Performance measurement is a critical step in the development and evaluation of every system. Generally, the bigger and more complex the system, the more challenging it becomes to measure effectively. A lot of supply chain frameworks have been developed in the literature however only little effort is done to effectively implement such framework in a business environment because of these challenges.
A literature study into performance measurement systems (PMS) and specifically supply chain PMSs has led to the conclusion that metrics are often categorized in a number of measurement categories. However these categories are very ambiguous and often unsubstantiated. This research has made an effort to consolidate the knowledge present in literature regarding this categorization resulting in five categories:

- **Costs**, the total cost of the supply chain based on process costing, inventory costs, and miscellaneous overhead costs.
- **Flexibility**, reflects the ability of the supply chain or company to respond to unexpected circumstances in operation and the market.
- **Quality**, the quality of service that the supply chain is able to deliver. This is depicted by the delivery of the product at the right time at the right place and lead time besides the satisfaction with the customer-supply chain relation.
- **Innovation**, is depicted as the amount of time and money the supply chain spends on the innovative character of the supply chain. This includes developing and sharing of knowledge throughout the supply chain that will benefit the supply chain as a whole and customer involvement in this process.
- **Corporate social responsibility**, depicted as the time and effort the supply chain puts to live up to their corporate social responsibilities regarding society and environment.

These five measurement categories have been developed to fit a number of requirements identified for SCM categories in which it differs with previous frameworks. The different measurement categories should be mutually exclusive implicating that what is measured in one category should not also be measured in another. Secondly the categories should be defined unambiguously to acquire a broad basis of support and avoid semantic mismatches (Nurmi, et al., 2010). This framework of measurement categories can therefore be depicted as an ontology-based semantic framework. Together these five measurement categories and associated performance metrics constitute a new supply chain PMS. Using the performance measurement system of Neely et al. (2005) the newly developed can be depicted as in figure i.

One of the critical issues that is associated with the design and implementation of a supply chain PMS is the lack of relation between strategy and operational performance. This research developed this relation through the tactical level of measurement. The measurement categories that have been depicted in the PMS are translated to strategic outcomes of the supply chain resulting in a supply chain strategy framework (figure ii). This supply chain strategy framework visualizes the strategy of the supply chain depicted by the customer orientation and links it directly to the individual measures of the measurement categories.
In interviews with a number of key persons of the sub-supply chain under investigation the developed framework was introduced and validated. The general opinion was that the framework was all including and very useful because of its comprehensiveness and unambiguousness. The respondents furthermore mentioned differences between the importances of the different strategic outcomes. Quality was depicted as the most dominant outcome, closely followed by flexibility, and costs. These three could therefore be identified as the primary pillars of supply chain strategy while CSR and innovation could be depicted as secondary pillars.

Figure ii, supply chain strategic framework and performance measurement system.

From discussions with practitioners it appeared that they lacked the knowledge and tools to translate scientific frameworks and models into useful practices. Therefore a tool was developed to assist the members of the supply chain to translate the scientific framework into a useful practice. The tool provides the practitioner with a hands-on tool that may be used to communicate with customers and supply chain partners by visualizing the expectations and performance on the different strategic outcomes. In this way differences in perceptions can be visualized which makes for better structured and efficient discussion regarding the performance of the supply chain as a whole and individual parties of the supply chain.

The tool was subsequently used in the interviews to map the valuations of the different respondents. The analysis of these valuations provided some interesting conclusions. There is no clear consensus on the competencies of the company between the employees which has a deteriorating effect on the performance and communication of the company. From the valuations of the perceived customer expectations could be concluded that Unilever has a clear view on the expectations of the customer does not unambiguously communicates these through the supply chain. Furthermore the link between what is measured and what is perceived as the demands of the customer was substantiated. Finally from the valuations of measurement could be concluded that no consensus is present on what is actually measured which may lead to counterproductive decision making in the supply chain. Because of this lack of consensus it could not be concluded whether the measures that are employed throughout the supply chain are in line with the strategic intent of the supply chain, the customer’s expectations.
One aspect that became very clear from this research and interviews was the psychological aspect that is associated with SCM. One of the most crucial requirements for effective SCM is mutual trust. To effectively manage the supply chain as an integral entity the different parties of the supply chain should be willing and able to share information with the other parties to show their commitment. Only when information regarding processes, costs and other business related aspects is shared is efficient management of the supply chain possible. Parties should be able to identify the implications and benefits of SCM although these benefits may not be directly visible or only after initiation of pain and gain sharing.

This research has furthermore shown the importance of SCM responsibility structure. The lack of clear supply chain responsibilities results in a lack of management and failing supply chain initiatives. Based upon this research and interviews it can be concluded that the structure in which a team comprised of employees of the different supply chain parties is favored over other structures. This consortium enables big amounts of knowledge to be shared and has a strong support base at each company. Furthermore it shows a sign of trust and commitment to SCM and each other which will have a beneficial effect on the communication between the consortium members and the development and implementation of supply chain initiatives. This redesign is broadly applicable to almost every supply chain as measurement will lead to behavior in every business practice.

Following the insights accumulated during this research, interviews and valuation the research question can be answered as following: supply chain performance measurement can play a huge role in supply chain management by providing the crucial link in strategic and operational alignment throughout the supply chain. One of the biggest obstacles of SCM is the lack of strategic alignment. The supply chain strategy framework that has been depicted in this research provides a clear communicative tool to discuss the lack of alignment in strategy. But as long as the PMS is not in line with the strategic intent companies will keep making counterproductive decisions, because measurement shapes behavior. Once the supply chain PMS is implemented and is in line with the strategic intent of the supply chain as a whole, companies will be more willing and able to exploit the implications of SCM because it has a positive influence on their performance towards the customer.

The strategic framework and associated PMS that has been developed joins an ever increasing group of scientific models. It distinguishes itself by establishing a link between scientific literature and a business environment, strategic intent and operational behavior, and finally customer’s expectations and supply chain strategy. The framework has been validated and designed to fit a specific business case but the research has led to the conclusion that its applicability reaches far beyond this single supply chain towards almost every supply chain. It is developed to be able to cope with future expectations of customers regarding sustainability both in environment and society, and focuses on the long term relationship which is crucial to the area of SCM.
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1. **Master thesis introduction**

Customers continuously adapt their expectations, demanding shorter lead times, higher quality, and highly specific products against lower prices. Traditionally each supply chain participant aimed to enhance performance of its own enterprise. In current economic conditions however it is no longer sufficient for companies to only pursue individual optimization. Continuously improving collaboration between all entities in the supply chain is no longer only a strategic choice, it is crucial to the sustainability of the companies (Ip et al., 2011). The importance of efficient supply chain management (SCM) is therefore clear but companies have yet to succeed in grasping the possibilities.

Nabuurs logistics is interested in the implications of efficient SCM and especially the practical issues that are associated with SCM. This research aims to contribute to the knowledge of Nabuurs and other supply chain parties of SCM in general. Furthermore an effort is made to distinguish issues associated with efficient SCM and how a performance measurement system (PMS) may contribute to the management of the supply chain.

1.1. **Research design**

One of the major issues associated with efficient SCM is the lack of strategic alignment throughout the supply chain. The core objective of all the parties in the supply chain should be to meet the expectations of the customer of the supply chain, and all the processes and decision making should be in line with this objective. The alignment of strategic intent of the different parties of the supply chain rises or falls with the correct PMS. As the supply chain fails to measure the performance of attributes that are in line with the strategy, the different parties will make disrupting decisions resulting in inefficient supply chain performance. It is therefore crucial that a performance measurement framework is developed that is in line with the expectations of the customer.

The aim of this research is therefore to identify and exploit the implications of supply chain PMSs on the efficiency of SCM. The insights that are acquired can then be used to develop a redesign for the management of the supply chain under investigation. This results in the following research question:

How can supply chain performance measurement contribute to the management of a supply chain?

1.1.1. **Underlying research questions**

To answer the main research question several sub-questions were formulated:

- What is the definition of SCM and what are its focus areas?
- What are the issues associated with PMSs?
- Which measurement categories can be distinguished which are in line with customer orientation of SCM?
- Which performance metrics should be employed to retain a supply chain focus?
- How should the responsibilities for SCM be structured?
For the supply chain under investigation a number of context specific research questions were formulated:

- Is there a clear understanding of SCM and its implications?
- Are the current performance metrics aligned with the supply chain strategy?
- Is the supply chain capable of employing efficient SCM?
- How are the responsibilities for SCM structured?

1.1.2. Research methodology

This research is comprised of two parts, supply chain and performance measurement literature analysis and a qualitative analysis of the supply chain under investigation. In the literature analysis issues associated with supply chain and performance measurement management will be depicted and used to gain insights in the issues and implications of present frameworks. A new supply chain performance measurement framework will be designed that will address the issues associated with current frameworks, and an Excel program will be developed to translate the scientific framework into a practical tool.

The framework will be used as part of an unstructured interview that will be performed among the key-persons present in the different supply chain parties. The unstructured interview will address a number of topics regarding SCM followed by a validation of the developed framework. After the framework is validated it will be used to analyze the current supply chain. The results from the framework valuation will then be analyzed to identify improvement possibilities and general implications on SCM in practice.

Summarizing the research methodology encompasses the following steps:

- SCM and performance measurement literature analysis.
- Development of a new supply chain performance measurement framework.
- Unstructured interviews with key figures in the supply chain.
- Framework valuation analysis.

The results from these steps will then be used to depict a SCM redesign for supply chains in general and specifically on the supply chain under investigation.

1.2. Report structure

The remainder of this report is outlined as follows. In chapter 2 a literature review is given of the subjects: SCM and performance measurement. Following these definitions a new literature based supply chain performance measurement framework is developed in chapter 3. Based upon the insights acquired from the literature and practice a general supply chain design is developed and elaborated upon in chapter 4. The developed framework is translated into a managerial tool which is introduced in chapter 5. In chapter 6 the business case of this thesis is depicted. Chapter 7 analyses the results of the unstructured interviews and chapter 8 the results of the strategic valuations. Following these analysis, chapter 9 depicts the recommendations for the supply chain under investigation. And finally chapter 10 concludes the report with concluding remarks and future research possibilities.
2. Literature review

In preparation of this master thesis a literature study (Meboer, 2013) has been executed in the research area of supply chain management and specifically performance measurement systems and frameworks within supply chain management. This chapter depicts a short summary of this literature review.

2.1. Supply chain management

Literature research shows the lack of a clear understanding of the term supply chain and supply chain management (Lambert et al., 2005; Lambert & Pohlen, 2001; Mentzer & al, 2001; Naslund & Hulthen, 2012; Stock & Boyer, 2009). SCM is regularly confused with logistics and operations management. These processes are crucial to the functioning of a supply chain but only comprise a part of the “entire” supply chain as these activities are usually within the purview of a single company. Larson & Halldorsson (2004) have researched this link between logistics and SCM using a four perspective model visualized in Figure 1.

![Figure 1, Four logistics vs scm perspectives (Larson & Halldorsson, 2004, p. 4)](image)

The traditionalist positions SCM within logistics. It reduces SCM to a special type of logistics focused on external or inter-organizational logistics. The relabeling perspective simply renames logistics to SCM. This implicates that the broad scope of SCM is narrowed, since SCM equals logistics. The unionist depicts logistics as a part of SCM; SCM completely subsumes logistics. SCM is an interdisciplinary concept incorporating fields as marketing, strategic planning, logistics, information technology, sales, and financial. The intersectionist suggests that SCM is not the union of the different functional areas logistics, purchasing, marketing, etc., but rather a broad strategic approach which includes elements of all these different disciplines.

Using this framework the authors carry out a survey among an international group of experts to see how they perceive SCM versus logistics. They find support for the existence of the four perspectives framework. This implicates that there is a diverse base of opinions what the relation between logistics and SCM constitutes, which has a deteriorating effect on the communication between practitioners. Practitioners should share a common perspective to collaborate effectively, or at least understand the perspective of the other parties. But it also has an effect on the SCM research area as researchers might possess different perspectives which influences the way they define SCM and develop theory.
Chan (2003) shared this view of logistics, following the Unionist approach. In order to make strategic decisions business need to manage the physical distribution of goods by performing trade-off analysis and distribution requirement planning. Logistics is the next step in this process which coordinates the cost, time, and holistic view of the market before making a decision. The supply chain is even more extensive. It is a continuous process, from raw materials to finished goods via the traditional functions as purchasing, forecasting, distribution, sales, and marketing. It consists of different levels, e.g. suppliers, manufacturers, distribution channels, and customers, and is therefore a network of companies that influence each other (Figure 2).

![Figure 2, supply chain overview (Chan, 2003)](image)

Before trying to define SCM it is crucial to define a supply chain. Mentzer & al therefore provide the literature with the following definition for a supply chain.

"A set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer" (Mentzer & al, 2001, p. 4)

This implicates that it is important to realize that supply chains exists regardless whether they are being managed or not. This definition for the supply chain will be used throughout this literature study. As soon as a party involved in the supply chain identifies the implications of managing the up- and downstream flows across their supply chain, it can be said to possess a supply chain orientation. Only when multiple directly connected companies possess a supply chain orientation as described, the identified implications can actually be implemented. Therefore supply chain orientation can be described as a management philosophy while SCM are the activities undertaken to realize this philosophy.

The ambiguities in SCM make it hard for practitioners to clearly define the function and responsibilities of a supply chain manager and benchmarking against competitors. This lack of a comprehensive definition also has a significant effect on the research area of SCM (Stock & Boyer, 2009). Without an encompassing definition, it is difficult for researchers to develop supply chain theories, define and test relationships, and develop a consistent stream of theory build upon earlier theory. Multiple definitions could be identified in the literature and their core competences were analyzed to gain insight in the true integral meaning of the term SCM.
Following this analysis the following supply chain management definition has been developed:

“Management, planning, and development of inter- and intra-organizational processes and information and financial flows aimed at coordination and collaboration between supply chain partners to fulfill the supply chain’s end-customer demands as efficient as possible.”

Literature has also shown the crucial role process thinking plays in SCM. Companies should migrate from a functional to a process orientation to align all the functions and targets throughout their organization. Multiple frameworks have been identified to facilitate such a migration and their strengths and weaknesses have been identified. These frameworks may provide a good reference point on which a new framework may be structured better suited to the current supply chain measures and outcomes. Only when companies are able to deploy such a structure within their company, will they be able to successfully deploy it across their boundaries.

Summarizing, SCM is a very broad and still ambiguous subject of study and business. However some things are clear, SCM concerns collaboration across organizational boundaries. SCM initiatives should be emphasized on goal alignment and customer satisfaction (Fawcett et al., 2007). This should be facilitated by a holistic view, total cost attitude, and process integration. In the following section the strategy of the supply chain is elaborated upon along the lines of goal alignment and customer satisfaction described above.

2.1.1. Supply chain strategy

As with every business it is crucial that an encompassing strategy is in place. This strategy ensures that all the different processes are focused on achieving the same results. However the notion of a right supply chain (strategy) cannot be generalized. This even further increases the complexity of SCM, as the strategy differs from context to context (Gopal & Thakkar, 2012). There has to be a clear synchronization between the supply chain strategy and characteristics of the product or service. However this is only part of the distinction of the supply chain. Recently supply chain managers have been recognizing that the initial pillars of SCM; cost effectiveness, lower lead-times, and better quality, can be extended with secondary, but equally important, pillars. Melnyk et al. (2010) identified a total of six outcomes that supply chains could be providing: cost, responsiveness, security, sustainability, resilience, and innovation (Figure 3). The choice of a supply chain manager for one or more of these outcomes has a big influence on supply chain characteristics and should be carefully considered.

Figure 3, Supply chain outcome company blend (Melny et al, 2010)
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The development of an integrated supply chain should furthermore be viewed from three different perspectives; strategic, tactical and operational (Stevens, 1990). The outcome orientation as identified is encompassed by the strategic perspective. The focus of the strategic level should be to develop objectives and integral policies for the supply chain. Furthermore it is concerned with the shape of the supply chain in terms of facilities and locations. And finally it should outline the organizational structure of the supply chain in terms of responsibility and activities.

The second level is the tactical level, which focuses on the means by which the strategic objectives will be enforced throughout the supply chain. It involves translating the objectives into process specific key performance indicators. Additionally, the tactical level is involved with determining the tools, approaches and resources needed to achieve the objectives, choosing the right information infrastructure and third parties. The development of a supply chain PMS can be distinguished as part of the tactical level.

The lowest level is the operational level, and is concerned with the daily operation of the supply chain. It focuses on the detailed systems and infrastructures that are in place to ensure an efficient operation. These operations are controlled with performance measures as depicted in the PMS of the tactical level. The links between the different levels enables supply chains to separate the strategic from the practical, while maintaining the alignment using the tactical level as intermediary.

Brignall and Ballantine (1995) describe the relation between strategy and performance measurement by defining the what and why of performance measurement. The why is based upon the need for correct and real time information on performance because of the forces shaping a competitive business environment. The what of performance measurement is the competitive strategy. Business mission and strategy type are the primary determinants of the mix and weighting of what is measured in a service’s PMS. This implicates that service providers following a cost leadership strategy would focus primarily on financial measures. This connection between strategic decisions and operational measures provides the basis for a lot of problems in PMS’s as will be elaborated upon in section 2.2.2.

2.1.2. SERVQUAL model

In the 1980’s the attainment of quality in products and services stood high on the agenda. While quality in tangible products was had been extensively researched and described, quality in services remained rather unexplored. Therefore Parasuraman et al. (1985) attempted to balance this situation by exploring the role of quality in four service businesses and by developing a model of service quality based on the acquired insights. This service quality model is also being referred to as the gaps model as it identified a number of gaps regarding executive perceptions on service quality and tasks associated with service delivery to customers.

Since the introduction of the SERVQUAL model in 1985 it has been used as an integrated framework across industries worldwide to help companies formulate strategies to improve service quality (Bitner, et al., 2010). Although the framework has been developed by marketers, its customer centric focus has made the SERVQUAL model widely cited and used across disciplines and functions. The primary goal of the model is to meet or exceed customer expectations, and strategies used to achieve that objective. It helps organizations to pinpoint areas requiring managerial attention and action to improve customer satisfaction with the provided service (Parasuraman, et al., 1988).
Figure 4 illustrates the SERVQUAL model with its denominators, stakeholders, and gaps. The customer gap is the crucial part of the model as the goal is to close the gap between customer expectations and perceptions of the service by meeting or exceeding their expectations. The other four gaps are called the provider gaps and represent potential causes of the customer gap. The SERVQUAL model provides the service industry with a clear agenda on which it should improve to attend to the customer’s demands better. The framework developed in this report attempts to resolve the provider gaps identified in the SERVQUAL model to increase the satisfaction of the customer.

Gap 1 is called the listening gap, it is the difference between customer expectations and the management's understanding of those expectations. There may be many reasons why this gap exists; they may not interact directly with their customers, they may be unwilling to ask for expectations fearing the consequences, or they may not speak the same language in terms of performance levels. Closing this gap requires that the supply chain acquires accurate and detailed information regarding the expectations of the customers.

Gap 2 is depicted as the design and standards gap, this gap focuses on the translation from expectations into actual service design and developing standards to measure service operations against customer expectations. The typical stepwise formalized procedure composed of steps as strategy formulation and idea generation is hard to implement because of the nature of services (process orientation, intangible, co-creation by customers). Strategies for closing this gap include employing well-defined new service development processes, understanding the total customer experience, and measuring service operations through customer-defined standards.

Gap 3 is defined as the service performance gap, although the supply chain might have addressed gap 1 and gap 2 successfully it may still fall short in providing the service that meets the customer’s expectation because it is unable to deliver the service as it was designed. In order to deliver the service as it was designed it is crucial that the different parties of the supply chain are willing and able to deliver the quality services they were designed to employ. Considerable attention should be focused on recruiting the right personnel, or in the case of a supply chain, the right companies.
Gap 4 is called the communication gap, this gap focuses on the difference between service delivery and what is communicated externally to customers. The challenge with this gap is that there is such a wide array of communication means available to current supply chains. To provide the customer with a clear and unambiguous communication the supply chain needs to communicate to the customer in one voice. Secondly customers are no longer content with a weekly or even monthly review. They want to be able to continuously assess the performance of the supply chain and all of its elements.

The supply chain can be identified as a service of the delivery of the production and delivery to the end-customer. Therefore the SERVQUAL model provides a framework of issues which may be present in managing the supply chain in an efficient manner. A new framework may be developed that is focused on closing these gaps resulting in a better match between the perceived and expected service. In the following section the topic of performance measurement will be elaborated upon which is a crucial part of the efficient management of the supply chain as a single entity.

2.2. Performance measurement

Performance measurement is the process of collecting, analyzing, and the reporting of information regarding the individual, group, organization, system, component, or in this case supply chain. The core purpose of a PMS is to quantify the efficiency and/or effectiveness of action (Neely et al., 2005). Effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how economically the firm’s resources are utilized.

Thomas Monson said: “When performance is measured, performance increases. When performance is measured and reported, the rate of improvement accelerates.” Managers can capture this performance improvement by leveraging the following three roles of measurement when designing a PMS (Fawcett, et al., 2007).

- Measurement creates understanding.
- Measurement drives behavior.
- Measurement leads to results.

Managers cannot effectively control processes that they do not understand, and they cannot fully understand a process without reliable and accurate measurement. This highlight the most basic role of a PMS in all contexts: providing insights into the nature and workings of business processes. In the case of supply chains this implicates understanding of boundary crossing processes and the guiding of company’s progress toward collaboration.

Measurement’s influence on behavior is pervasive because people tend to pay extra close attention to the points on which they are measured: “What gets measured, gets done”. Performance measures that are not in line with the overall long term strategy of the company may result in managers making decisions that are in their own favor rather than the strategy of the company. Measurement is more critical than communication, training, or perhaps anything else when it comes to managing human behavior. In the case of SCM this shaping of behavior can be translated into company performance, companies will pay close attention to the measures they are being monitored upon by the customer or supply chain manager.

Thirdly, rigorous, thoughtful measurement always precedes strategic and operational excellence resulting in best in class results: measurement leads to results. As important as it is to measure the right things, it is just as important to measure them in the right way. This implicates that companies need to keep three characteristics in mind when designing a PMS: provide accurate and relevant performance
information in a *timely manner* (Fawcett, et al., 2007). When supply chain managers have this kind of information at their disposal and it is shared throughout the supply chain, effective decisions can be made resulting in distinctive collaborative capabilities.

Gopal and Thakkar (2012) acknowledge the role of performance measurement in the alignment of supply chain performance. They furthermore note that performance measures and metrics will also facilitate a more open and transparent communication between people, leading to a co-operative supported work environment and hence improved organizational performance (Akyuz & Erkan, 2010). Being clear about what is measures and why, addresses a lot of the issues concerned with the alignment of actions in the different parts of the supply chain. However the development of a PMS is not a one-time effort, it needs constant updating and reviewing to keep up with changing demands of the market and influences of the business environment.

### 2.2.1. Supply chain performance measurement systems

The selection of supply chain measures to incorporate into the system is critical because managers have to evaluate supply chain on various aspects as a whole entity rather than on an individual basis (Gopal & Thakkar, 2012). The collection of selected supply chain measures is called a performance measurement system. The PMS should be more than just a disparate assortment of these individual metrics. The system as a whole should be valid, robust, integrative, economical and compatible with the business environment. Akyuz and Erkan (2010) have identified the different purposes of a PMS which are generally in line with the purpose of performance measurement described in the previous section:

- Identifying success.
- Identifying if customer needs are met.
- Better understanding of processes.
- Identifying bottlenecks, waste, problems and improvement opportunities.
- Providing factual decisions.
- Enabling progress.
- Tracking progress.
- Facilitating a more open and transparent communication and co-operation.

The purpose of identifying bottlenecks, waste, problems and improvement opportunities displays that the role of a PMS extends beyond the individual performance measures. It should provide a framework in which the different individual measures are incorporated in a logical and orderly fashion.

![Figure 5, performance measurement system framework (Neely, et al., 2005)](image)
Neely et al (2005) introduce a framework (Figure 5) which visually positions the PMS and highlights that a PMS can be examined at three levels: The individual performance measures, The set of performance measures – the PMS as an entity, and The relationship between the PMS and the environment in which it is employed. Each level of the framework can be analyzed by a number of specific questions which clarify the different levels in more detail. The first level can be analyzed using questions such as: “What performance measures are used?” and “What are these measures used for?”. At the second (higher) level, the PMS can be analyzed by exploring issues as: “Have measures which relate to the rate of improvement been introduced?” and “Do any of the measures conflict with each other?”. Finally the relation between the system and the environment can be analyzed by assessing the following topics: “whether some measures focus on customer satisfaction.” and “whether the measures reinforce the firm’s strategy.”.

2.2.2. Performance measurement system issues

There is a lot of literature on the issues associated with PMS’s. This section will elaborate upon a number of these issues which need to be addressed in a framework to provide a good basis for a new PMS. Neely et al. (2005) have identified a list of issues concerning PMS’s design, which are directly applicable to the supply chain PMS’s design. This list has been extended to include authors that identified the same issues and distinctively different issues:

- Lack of connection with strategy (Beamon, 1999; Gunasekaran, et al., 2003; Chan & Qi, 2003; Akyuz & Erkan, 2010)
- Focus on financial to the detriment of non-financial indicators (Beamon, 1999; De Tony & Tonchia, 2001; Akyuz & Erkan, 2010; Chan & Qi, 2003)
- Lack of a balanced approach (Chan, 2003; Beamon, 1999)
- Insufficient focus on customers and competitors (Beamon, 1999)
- Loss of supply chain context (Beamon, 1999; Chan, 2003; Lambert & Pohlen, 2001)
- Lack of system thinking (Chan, 2003; Chan & Qi, 2003)
- Inconsistencies and conflicts between measures (Akyuz & Erkan, 2010; Neely et al., 2005)
- Too small or large set of measures (Akyuz & Erkan, 2010)

The first issue that has been identified is the lack of connection between the strategy and the PMS, as was also addressed as one of the issues of SCM in general. The measures that are developed on the tactical level should be in line with the strategy depicted on the strategic level to make sure that the right behavior of employees and companies are shaped. This inconsistency corresponds to the design and standards gap of the Gaps model.

In PMS’s the focus has always laid on financial measures to the detriment of non-financial measures. This issue has been extensively covered in performance measurement literature and is caused by the idea that the sole strategy of a company should be to make profit. However in current business environment continuity is far more important than profit and is shaped by more factors than just financial. Therefore a PMS should provide the managers with a balanced approach of financial and non-financial measures.

To identify the proper measures for this balanced set of measures the supply chain should identify the implications of value. The end-customer of the supply chain is the only entity that provides the supply chain with value. Therefore there should be a strong end customer orientation throughout the supply chain. To facilitate this end customer orientation measures should be developed following the question “What does the customer want from me?”. As identified by gap 2 of the SERVQUAL model. This implicates that it becomes more important to identify value-adding activities and processes rather than pursuing costs.
The first issue is related to PMSs of separate entities of the supply chain but while focus should lay on measuring the performance of a supply chain as a whole. As described in the previous sections historically the focus always laid on internal efficiency with associated PMS’s. The supply chain should however be managed and measured from a holistic view to maintain supply chain context and integrate systems thinking into the supply chain. Measures should therefore be identified from a supply chain perspective rather than individual perspective, resulting in a set of measures that focus the supply chain as a whole on the strategy that is in line with the end customer demands.

Following the previous issues the PMS might end up with a large incomprehensive set of measures, which makes it difficult to identify the critical few among the trivial many. This may result in an abundant amount of performance data which will hinder the ability to act upon lacking performance. Having too few measures has the same consequences as no measurement: lack of understanding, misbehavior, and deteriorating results. Furthermore the set of measures depicted in the PMS should be developed with an integral view, identifying inconsistencies and conflicts between measures.

### 2.2.3. Supply chain measurement categories

To gain insight in the measures that should be incorporated into a PMS, measures are often grouped according to their definition. Table 1 shows the different literature sources that are used and the associated measurement categories. Based upon the article associated with the category a short description of each category is set out in Appendix A: Measurement categories.

#### Table 1, overview of categories in literature

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3. Development of a new supply chain framework

In this section a new strategic framework will be developed on the basis of performance measurement categories to support a new supply chain PMS. In section 3.1 the PMS is positioned within the environment. Section 3.2 develops the new measurement categories based upon the categories found in the literature. In section 3.3 the performance metrics associated with the measurement categories are depicted. Section 3.4 introduces the newly developed framework followed by an elaboration upon the implications of this new supply chain framework in section 3.5. And finally section 3.6 depicts a short conclusion on the proposed framework.

3.1. Supply chain performance measurement system

To gain more insight in the specifications and effects of different individual measures a number of authors have introduced measurement categories (Supply-Chain Council, 2008; Fawcett, et al., 2007; Melnyk, et al., 2010; Beamon, 1999; Kleijnen & Smits, 2003; Brignall & Ballantine, 1995; Kaplan & Norton, 1996; Chan, 2003). In Figure 6 the implementation of measurement categories are visualized into the model of Neely et al. (2005), Figure 5. The individual metrics are now grouped into measurement categories. In contradiction to the original model, the individual measures and measurement categories do not overlap but are designed to measure various processes or results and should therefore be mutually exclusive.

In both frameworks the PMS has a direct relation with its environment. However in the original framework this environment constituted the focal company but in the new framework the environment comprises the supply chain as a whole. The revised PMS framework now facilitates the examination on four levels:

1. The individual performance measures, the tactical performance measures that actually measure operational performance.
2. The performance measurement categories, the relation between the strategic outcomes a supply chain can aim for.
3. The performance measurement system, the set of measurement categories encompassing the overall strategy of the supply chain.
4. The relation between the performance measurement system and the environment, the position of the set of strategic goals of the system within the environment.

Figure 6, revised performance measurement system framework
One of the problems with the literature regarding performance measurement literature is that it is very
diverse, as can be seen in Table 1, overview of categories in literature. Different authors tend to focus on
different aspects of the supply chain or have different opinions what should be combined. This results in
different definitions for the same category. Some describe flexibility as being able to quickly adapt
production quantities while others define flexibility as the ability to quickly introduce new products to the
market (Neely, et al., 2005). And the core to this problem lies in the fact that none of the articles analyzed
describe where the categories originate from or refer to other articles. In the following section an effort will
be made to distinguish the prerequisites for the supply chain categories and using the diverse literature
based database of categories a new comprehensive framework will be developed.

3.2. Measurement categories

To develop a broadly applicable and useful framework, the performance measurement categories of
the framework need to be distinguished unambiguously as Figure 6 displays, the different measurement
categories of the framework should not overlap, in contrary to what the framework of Neely et al. (2005)
suggests. This implicates that the measurement categories need to define different areas within
performance measurement and should therefore be mutually excluding, what is measured in one
measurement category should not also be measured in another.

The need for this mutually exclusiveness arises from the nature of the framework. It should not be
possible to improve the performance of one of the measures without a negative influence on one or more
of the other measurement categories. A simple example suffices: the use of electric trucks improves the
performance of corporate social responsibility (CSR), but raises the operation and investment costs. In this
way the designed framework reflects the business environment, as companies and supply chains always
need to make a balanced decision between different outcomes. This requirement excludes the possibility of
technological or process advances in different areas in which it may be possible to increase performance
without negative influences.

3.2.1. Measurement category literature review

The categories of the framework are based upon the literature reviewed in section 2.2.3. The
description of the categories of each of the articles have been reviewed and clustered into groups
containing similar key words and meaning. This results in a number of five groups of descriptions which are
reviewed to identify shared content (Table 2). Using these shared contents, five comprehensive categories
could be depicted: cost, flexibility, CSR, innovation, and quality. These are the five categories that will form
the core of the framework.

As can be seen from Table 2 some of the measurement categories are comprised of more categories
than others. For example quality is depicted in 8 different manners; this is due to the fact that quality is
rather ambiguous. It may involve qualitative or quantitative measures and may be depicted as the customer
category rather than quality. This report assumes that the delivery of the product to the customer as the
product of the supply chain, therefore the quality of the supply chain is the delivery to the customer and
the interaction with the customers.
Table 2, measurement category identification

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Two of the categories have not been assigned to any of the categories: internal processes and competitiveness. The internal processes are described as the efficiency of the processes in the supply chain. In this framework the internal processes are depicted as the way performance in the categories is realized rather than the performance results. Therefore it cannot be assigned to any of the categories. Competitiveness is important for managers who aim to beat the competitors, including measures as relative market share. The aim of every supply chain is to outperform the competitors and retrieve as much value out of it. Therefore distinguishing on any of the measurement categories may result in a higher relative market share depending on the demand of the customers. The framework is focused on the customer and associated revenue and depicts competitiveness as a result of the performance of the supply chain rather than the aim.

### 3.2.2. Cost

One of the considerations for this financial category is whether it should be solely focused on the costs made in the different departments/processes, as with many of the analyzed articles, or on financial results in terms of profit. Companies will always strive for higher profits which can be achieved especially, but not solely, by decreasing costs. However other financial performance measures such as EPS and ROI are “lagged indicators” which are the result of managerial actions and organizational performance, and not the cause of it (Brignall & Ballantine, 1995). As performance measures should aim at improving the causes of company performance the focus of the financial measure is on costs rather than financial results.
A second consideration is how to incorporate assets into the PMS. Long term assets play a big role in logistics as large investments are usually necessary in order to set-up and maintain a profitable organization. Investments like large warehouses and fleet of trucks carry fixed costs which need to be paid whether or not they are utilized. This means that a high utilization percentage needs to be attained to keep the investments viable. In my opinion this asset utilization is encompassed by the cost category as inefficient use of assets will have a deteriorating effect on the financial performance of the company. A good example of a cost factor that includes this productivity factor is activity based costing in which overhead costs are assigned to products via the activities needed to produce the product. Activity based costing is very useful in SCM as it is in line with the process view needed. It makes it also easier to identify redundant non-value adding processes which can be removed to make the supply chain leaner.

However activity based costing does not comprise all costs made in the supply chain. Some costs cannot easily be assigned to specific activities. An example is project costs, when the supply chain spends time and money on a new innovative project to increase the productivity but it is rejected the costs cannot be assigned to current products. They do however contribute to the total costs of the supply chain and should therefore be managed. Using the total costing (Fawcett, et al., 2007) method, in which all the costs related to a decision are summed up, accurate decisions can be made whether the benefits outweigh the expenses.

Secondly activity based costing does not contain inventory costs. As holding inventory is not a value adding activity it should be minimized as much as possible. However to maintain a certain degree of flexibility and quality inventory is needed. This clearly shows the relation between the different categories and measures. Improving the inventory levels increases costs, but improves flexibility and quality.

In a business environment a company or supply chain that is focused on costs will use highly standard processes, deliver a standardized product in high volumes, and will need predictable demand. This implies that the focus will lie on a lean organization. The price is usually the order winner assuming the service meets a minimum quality and delivery reliability. This results in the following description for the cost category:

*The cost category can be described as the total cost of the supply chain based on activity based costing, inventory costs, and miscellaneous costs such as project costs.*

### 3.2.3. Flexibility

Flexibility is defined as the ability to respond to changes. More specifically it is the ability to change something (for example; product, process or volume) in relation to the other performance measures (De Tony & Tonchia, 2001). Changes in environment, technology, products, or processes all have a different effect on the supply chain and should therefore all be encompassed in this category. Much of the existing research has tried to identify the associated categories of flexibility with the different changes (Stevenson & Spring, 2007; Vickery, et al., 2006; Moon, et al., 2012).

Vickery et al. (2006) splits up flexibility in five categories: product, volume, launch, access, and target market flexibility. Product flexibility is the ability to handle difficult non-standard orders. Volume flexibility is the ability to rapidly adjust capacity to adjust to customer demand. Launch flexibility is the ability to rapidly introduce new products or variations on existing products. Access flexibility is the ability to effectively respond on changing distribution coverage. Finally responsiveness to target market flexibility is the ability to the long term needs and wants of the target markets. The survey performed by the authors result in distinctive relations of the different flexibilities on firm performance and correlation between the flexibilities.
Moon et al. (2012) develop and test a four factor second order model. The four factors constitute: sourcing, operating system, distribution, and information system flexibility. Sourcing flexibility is defined as the availability and sourcing of qualified materials and services. Operating system flexibility is the ability to exploit the sourced materials to produce the wide range of demand for products of the market. Distribution flexibility refers to the ability to control the movement and storage of materials and finished goods by managing distributors, warehouses, loading capacity, and distribution facilities. Information system flexibility is a new factor introduced by the authors and can be defined as the ability of the organizations information system to adapt to changing circumstances.

Following the distinctions made in the literature, flexibility can take on a lot of different forms depending on the environment and the company but it always reflects the ability to respond to changes, either in a day to day setting (operational flexibility) or in a long term market setting (market flexibility). Therefore in this framework, flexibility is defined as following:

*The category flexibility reflects the ability of the supply chain or company to respond to changes in the environment. This ability can be divided up into operational and market flexibility.*

### 3.2.4. Quality

Quality means different things to different people, the term is widely used but the concept and vocabulary is elusive. According to ISO 9000 (ISO, 2013) the definition of quality is: “*The degree to which a set of inherent distinguishing features fulfills needs or expectations.*”. In SCM the set of inherent distinguishing features is the structure and involved parties of the supply chain, and the needs or expectations are shaped by the end customer. In the ideal SCM world the supply chain would be managed from the supplier of the raw resource all the way to the shelf in the store. And the expectation of the end customer could be depicted as following: the right product being available at the exact time the customer wants to grab it off the shelf.

In the manufacturing sector quality is related to the product specification and number of defects. In SCM the product is the service to deliver products to the consumer as described above. Therefore quality of the supply chain product is the time that is needed to deliver the product, specification, and the number of times that the right product is at the right place at the right time, number of defects.

Quality is related to but not equivalent to customer satisfaction. Customer satisfaction is denominated by factors as communication, trust, and transparency which can be measured using scorecards. Furthermore customer satisfaction is also influenced by the other measurement categories: CSR, costs, flexibility, and innovation.

In a business environment quality is usually a qualifier rather than an order winner. As no company can provide 100% performance a minimum required quality is set to filter out under-performing supply chains and costs and other characteristics determine the supply chain. In the supply chain quality is usually depicted as the lead time and delivery guarantees. Therefore the focus lies on smoothing out processes throughout the supply chain to reduce lead time and improve delivery reliability. Following the definition of ISO 9000 (ISO, 2013) the quality category is defined as following:

*The quality category is described as the quality of service that the supply chain is able to deliver. This is depicted by the delivery of the product at the right time at the right place, lead-time and the satisfaction with the customer-supply chain relation.*
3.2.5. Innovation

The first three measurement categories have been extensively depicted in literature and have also obtained their place in business practices. Its direct relation with business activities makes it easy for managers to implement and measure these kinds of measurements. The other two measurement categories, innovation and CSR, are not directly related to business processes and should therefore be implemented alongside the core business of the supply chain. These measures are more focused on the long term sustainability of the supply chain.

In the literature numerous authors describe the role of innovation in the supply chain and its associated measures (Chan, 2003; Brignall & Ballantine, 1995; Kleijnen & Smits, 2003; Melnyk et al., 2010; Kaplan & Norton, 1996). However the exact definition of innovation within a supply chain lacks in all cases. Traditionally innovation can be divided up into product and process innovations. This distinction is very clear in the manufacturing industry, if a new product is designed and commercialized it is called a product innovation, if the process of making the product is innovated it is called a process innovation. In the service sector however this division is rather ambiguous because the process the company provides is in fact their product. Therefore innovations that change the way a company delivers a service to the customer can be classified as a product innovation. As companies increasingly recognize the implications of servitization, translating a tangible product into a service, this differentiation between process and product will become more incommodious. Therefore the term service innovation has been introduced (Nam & Lee, 2010).

Previous studies have identified the incorrect assumption that service and manufacturing innovation have a lot of similarities and has led to the development of diverse methodologies. From these methodologies two significant results can be extracted: firstly the customer is a co-creator of value, and secondly it emphasizes the collaborative relationship with all the participants. These results are clearly in line with the SCM philosophy. Therefore supply chain innovation can be described as service innovation and can use the vast amount of frameworks associated with service innovation. Using the two dimensions distinguished from the literature base Nam and Lee (2010) have proposed the framework as illustrated in Figure 7.

![Figure 7, innovation framework (Nam & Lee, 2010, p. 8)](image)

Innovation however does not have a direct positive influence on the customer. Therefore only customers that are able to identify the long term implications of innovation of their supply chain partners award value to an innovative supply chain. This means that customers need to be willing to implement long term contracts in which innovative supply chains will have a beneficial effect in terms of quality and costs in the long term. In a business environment an innovative supply chain is characterized by the use of highly sophisticated information technology and budget for innovative projects. They are focused on the sustainability of the company on the long term to attain and maintain market share and profits. The innovation category is defined as following:

*The innovation category is depicted as the amount of time and money the supply chain spends on the innovative character of the supply chain. This includes sharing and developing knowledge throughout the supply chain to facilitate the development of innovations that will benefit the supply chain as a whole and customer involvement in this innovation process.*
3.2.6. Corporate Social Responsibility

Even though the world is currently in wild financial weather, companies are well aware of their increasing corporate social responsibility (maatschappelijk verantwoord ondernemen (MVO) in Dutch). This implicates that companies can no longer only aim for individual financial gains but that the society should also benefit in one way or another. Bjorklund et al. (2012) identify the stakeholders’ perspectives as one of the key dimensions in the greening of supply chain. This stakeholders’ perspective can be described as the goal of taking your social responsibility. In the case of laws defined by the government that enforce certain social responsibility it has to be measured and treated as a fixed parameter. In the case of image improvement it is a financial incentive, in which the definition of responsibility should be seen rather broad. The extra profits of making social responsible decisions should offset the extra costs. CSR can be roughly divided up into two categories; society and environment (Hutchins & Sutherland, 2008).

3.2.6.1. Society dimension

Recently the government (kabinet), employees and employers have been working on a labor agreement (sociaal akkoord). One of the main topics of this agreement was the employment of (partly) handicapped people. The goal of the government is to reduce the number of social workplaces subsidized by the government and increase the amount of disabled people filling regular jobs. The initial coalition agreement depicted a quota of 5% for companies for hiring disabled people (Nederlandse regering, 2012). However companies have the chance to prevent the introduction of this quota in 2017 when they succeed in realizing 11,000 jobs for disabled people. Either way, it is evident that companies should start taking their responsibility to hire disabled people. Besides the governmental pressure, customers could demand a certain amount of social responsibility in this area which will boost the image of the company. And finally companies will also be confronted with the fact that a lot of disabled people still have a lot to contribute to a company and may fulfill a job better than another employee.

Internationally corporate responsibility for the wellbeing of the entire society is also highly valued. The United Nations Division for Sustainable Development (UNSD) provides leadership in promoting and coordinating implementation of the sustainable development agenda of the United Nations (United Nations, 2013). This organization has adopted a specific framework for measuring progress towards sustainability via indicators tied to the Millennium Development Goals (Hutchins & Sutherland, 2008). The themes within the society dimension of social responsibility are: equity, health, education, housing, population, and security (Table 3). Each theme has sub-themes (e.g. sanitation, literacy) which have at least one quantifiable indicator associated with it (e.g. Floor Area per Person, Adult Literacy Rate). This framework is rather extensive and many indicators are obsolete in a lot of well-developed European countries, however it does provide the reader with an insight in what factors should be kept in mind when thinking of the society dimension.

Finally the contribution to public welfare can be distinguished separately. Organizations might be affiliated with charitable causes; sponsoring sport events, contributions to public welfare organizations, etc.. This affiliation shows that companies take their social responsibility beyond the boundaries of their organization and try to enhance the society as a whole. Contributions as depicted can be easily quantified however facilities or activities provided to enhance the satisfaction of life from the employees might also be encompassed by this factor as it has a positive impact on the society.
Table 3, small dissect of theme indicator framework (UNDSD, 2001)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Living Conditions</td>
<td>Floor Area per Person</td>
</tr>
<tr>
<td>Security</td>
<td>Crime</td>
<td>Number of Recorded Crimes per 100,000 population</td>
</tr>
<tr>
<td>Population</td>
<td>Population change</td>
<td>Population Growth Rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Population of Urban Formal and Informal Settlement</td>
</tr>
</tbody>
</table>

3.2.6.2. Environment dimension

The second dimension of CSR concerns the environment. Green SCM plays a significant role in current supply chain research. A search query “green supply chain” in scientific literature library FOCUS yields a total of more than 13,000 articles since 2010. This growth in interest in the “greening” of supply chains is encouraged by a number of factors. The government is demanding companies to take more responsibility on their consequences on the environment by issuing new laws and regulations. But besides conforming to these new laws and regulations companies take up their own responsibility as a green supply chain has become a clear image booster in the sector. In a highly dense sector as logistics it is crucial to distinguish yourself in every way possible and being environmentally responsible is highly appreciated by customers. This because employing a logistics service provider that is environmentally responsible makes them indirectly environmentally responsible as well. The use of green energy is an example of such a choice, the energy company employs environmentally responsible processes and the logistics company makes use of this “green” image. The Lean and Green Award (Connekt, 2013) is an incentive program introduced by Connekt, an independent network of companies and public authorities, to stimulate the development and employment of sustainable solutions. The award is being awarded to companies which come up with a plan to reduce carbon emissions by 20% in 5 year. Awards like the Lean and Green Award give companies a clear sustainability goal and provides the company with a certificate to show their efforts to potential customers.

The link between environmentally responsible decisions and logistics is easily made by the carbon footprint logistic companies make. There are however a lot more environmental measurement areas (Cuthbertson & Piotrowicz, 2011; El Saadany, et al., 2011). All of these areas could be improved upon to enhance their CSR and enhance their image with respect to the society and their customers (Table 4).

Table 4, small dissect of environmental measures (UNDSD, 2001)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution</td>
<td>Amount and type of landfill waste</td>
</tr>
<tr>
<td></td>
<td>Amount and type air emissions</td>
</tr>
<tr>
<td></td>
<td>Amount and type water waste</td>
</tr>
<tr>
<td>Resources</td>
<td>Gas, water and electricity usage</td>
</tr>
<tr>
<td></td>
<td>Renewable resources</td>
</tr>
<tr>
<td></td>
<td>Use of environmental friendly raw materials and packaging</td>
</tr>
</tbody>
</table>

3.2.6.3. Corporate social responsibility measurement category

As depicted in the introduction of this section CSR has become a crucial factor in the image of a company and should be carefully managed. This holds both for the focal company as for customers and suppliers defining the supply chain. Therefore it is obvious this social responsibility should be measured and managed throughout the supply chain relationships. None of the authors, besides Mylnek et al. (2010) with
sustainability, have identified social responsibility as one of the key measurement categories. In my opinion this area is becoming increasingly important for interactions with suppliers and customers and should therefore be implemented in current supply chain PMSs besides other categories.

In a business environment CSR can be identified in the amount of time and budget are spent on projects to improve the influence on the society and environment. Taking CSR shows that the supply chain is aware of its influences on its environment and looks beyond profit to create value. Furthermore it shows the long term vision of the supply chain and companies. The CSR category is defined as following:

The corporate social responsibility category is depicted by two dimensions, society and environment. Society constitutes factors as health, education, job, and charity. Environment incorporates factors as pollution and resource utilization.

3.3. Performance metrics

In this section a distinction will be made between the different tactical key performance indicators (KPI) that may be assigned to the different measurement categories. The assignment of KPIs is an attempt to provide a basis of context independent KPIs that are applicable to all supply chains. However it does require a supply chain orientation, customer focus, and the acknowledgement of a supply chain as a service to the customer. The list of KPI’s is developed on the basis of literature (Chan, 2003; De Tony & Tonchia, 2001; Neely, et al., 2005; Nurmi, et al., 2010; Gunasekaran, et al., 2003; Fawcett, et al., 2007; Shepherd & Gunter, 2006; Shaw & Grant, 2010), discussion with key figures in the supply chain and own insights in SCM.

3.3.1. Performance metric requirements

Performance measures will be one of the main communications towards the customer. Therefore performance measures should be clearly defined as customers might define in time delivery different than the supply chain (Nurmi, et al., 2010). The supply chain parties and customers have to agree on how they will measure the performance of their shared inter-organizational processes. Detecting these semantic mismatches will aid supply chains in their PMS design. As the entire supply chain the PMS should be customer oriented, it should emphasize on what the customer finds important.

Akyuz & Erkan(2010) have extended these requirements and have identified a list of characteristics that new era performance metrics should include on basis of the characteristics and requirements of proper performance measurement. Performance metrics should, among others:

- Truly capture the essence of organizational performance.
- Based on company strategy and objectives.
- Reflect a balance between financial and non-financial measures.
- Relate to strategic, tactical and operational levels of decision making and control.
- Be comparable to other performance measures used by similar organizations.
- Allow for setting targets, aggregation and disaggregation.
- Allow prioritization/weighting.
- Avoid overlaps.
- Be simple and easy to use, preferably in the form of ratios rather than absolute numbers.
- Be valid and reliable.
- Be coherent and transparent.
3.3.2. Supply chain performance metrics

Following the requirements and the need for unambiguous performance measurement a number of metrics for each measurement category of the proposed framework is developed, these result in a comprehensive set of unambiguous metrics clearly linked to the strategic intent (Table 5). The different performance metrics have been depicted in more detail in Appendix B: Performance metrics.

Table 5, performance metric overview

<table>
<thead>
<tr>
<th>Measurement category</th>
<th>Metric 1</th>
<th>Metric 2</th>
<th>Metric 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Activity based costing</td>
<td>Inventory costs</td>
<td>Other overhead costs</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Operational flexibility</td>
<td>Market flexibility</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>Customer case fill on time</td>
<td>Lead-time</td>
<td>Customer satisfaction</td>
</tr>
<tr>
<td>CSR</td>
<td>Society</td>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>Internal innovation</td>
<td>Networked collaborative innovation</td>
<td>Customer co-creative innovation</td>
</tr>
</tbody>
</table>

3.3.3. Benchmarking

The environment of a supply chain can be assumed to consist of customers and competing supply chains (Neely, et al., 2005). The proposed framework provides managers with information relating to both of these external factors. The measurement categories have been depicted to be in line with the expected service of the customer and therefore customer satisfaction has already been elaborated upon. Benchmarking is the formal process of comparing the attributes of one organization to those of others. Benchmarking helps a company to assess and improve its own competitive abilities by identifying areas in which the competition is outperforming the company. Research has shown that high performing companies are likely to be active bench markers which indicate that benchmarking is crucial for the continuity of the supply chain (Fawcett, et al., 2007). There are four basic types of benchmarking (Neely, et al., 2005):

- **Internal.** Internal to a corporation, but perhaps external to a plant or a particular business unit. One of the major advantages of internal benchmarking is that it minimizes problems of access and data confidentiality.
- **Competitive.** This is probably the most beneficial form of benchmarking, but the collection of data which is directly comparable is very difficult.
- **Functional.** Functional comparison with similar companies, but not direct competitors.
- **Generic.** The study and comparison of truly generic business process, e.g. order entry, invoicing.

A supply chain may choose to focus on one or a combination of these types in their benchmarking process. This provides the supply chain with clear implications of their PMS by assigning value to the data is acquired by the PMS in terms of competitive edge. Managing the benchmarking process is therefore crucial for the possible implications of an innovative supply chain wide PMS. The supply chain should always retain their customer focus and aim to fulfill the expectations of the customer, but should keep a close eye on the competition to identify possible risks and opportunities.

3.4. Supply chain strategy framework

The new supply chain strategy framework is developed on basis of the revised PMS of Figure 5, performance measurement system framework (Neely, et al., 2005), the outcome driven supply chain framework (Melnyk, et al., 2010), and the depicted measurement categories. The PMS is built up around
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

the presence of measurement categories as depicted in the previous section: quality, costs, innovation, flexibility, and innovation. These measurement categories can be translated into strategic outcomes for the supply chain. Figure 8 visualizes this innovative framework that combines the blended supply chain outcome graph and the depicted measurement categories in a graph.

Customer orientation has been identified as key for the development of the strategy for efficient SCM. This strategic framework maps the expectations of the customer on the different measurement categories by valuing each measurement category with a score from 0 to 4 reflecting the importance of the category. This results in a visual overview of the expectations of the customer. This overview provides clear guidelines in the initial discussion with the customer on the importance of different aspects of the supply chain. This will enhance the perception of the management of the expectations of the customer. When the expectations of the customer are clear the same map can be used as the strategy for the supply chain as the strategy of a supply chain should be to fulfill the expectations of the customer as good as possible.

The framework may also be used to map the competencies of the current supply chain. Each company in the supply chain may be analyzed by performing an inquiry among the employees of the different companies. This may result in irregularities in vision towards own performance between different departments inside the company which is detrimental to the performance and communication of the company. Furthermore other parties in the supply chain may score the performance of the company to distinguish irregularities between the perceived competencies of the focal company. This analysis process should be an ongoing process during the entire service contract to make sure that the performance is still in line with the expectations and it furthermore shows commitment which provides the customer with trust.
The supply chain PMS can be developed based upon this framework. The measurement categories form the basis of the PMS. Each of the measurement categories employs tactical individual metrics which can be measured on the operational level. The performance measurement framework depicted by Neely et al. (2005) positions the PMS in the environment. This environment is constituted by the users of the PMS, the competitors which are used to benchmark against, and the customers. Figure 9 visualizes the resulting framework that incorporates the unambiguous and mutually exclusive measurement categories and its associated individual measures. Together the measurement categories shape the PMS. This PMS provides the supply chain with an explicit link between the strategic intents and the operational performance.

3.4.1. Valuation scorecard

The framework of (Melnyk, et al., 2010) describes the possibility of blended outcomes for a supply chain but does not provide a description on how this division is depicted. The SCOR framework (Supply-Chain Council, 2008) uses three prioritization levels; one superior, two advantage, and two parity. One superior depicts that the company should perform in the 90th percentile of the population, two advantage is the midpoint of parity and superior, and parity depicts the median of the statistical sample. The supply chain depicts for each measurement category in which level they want to perform, implicating their supply chain strategy. Following the philosophy that you need to have the most data where performance is most critical the number of metrics increases when the prioritization level increases. A low prioritization level, parity, results in the measurement of only level 1 metric, for example total supply chain cost for the cost category. While a high prioritization level results in a very detailed measurement of the category, for example shipping document accuracy and delivery quantity accuracy for the reliability category.

The SCOR valuation method is based upon benchmarking with other supply chains and is focused on identifying and enhancing their own strategy. This method requires a large database to benchmark and is very inflexible; furthermore it fails to identify the goal of the supply chain from the customer’s perspective. Secondly the SCOR framework does not describe a method that can be used to identify which level each of the categories should be. This implicates that a supply chain might choose a high priority for all the categories resulting in a huge base of metrics that need to be measured and analyzed. The framework described in this report is focused on the customer rather than the competencies of the supply chain. Therefore the designed and managed supply chain results in the performance that fits the customer’s expectations. This method holds both for existing supply chains that want to fulfill the demands of customers better and for the design of new supply chains identifying the strong and weak points of the supply chain.

The valuation scorecard that is developed tries to enlighten the relation between cost and non-cost metrics which was depicted as an issue by De Tony and Tonchia (2001). The scorecard provides the user with ten points that can be divided over the categories with a minimum of zero, not important, to a maximum of four, crucial resulting in a graph as depicted in Figure 8. The values can be determined by the demands of the customer which provides the supply chain with a strategy that needs to be employed for the supply chain as a whole. The framework may also be used to map the strong and weak points of companies and the supply chain as a whole to distinguish possible improvements. Following this valuation a visual representation of the alignment of the performance and demands for the different measurement categories is depicted. This framework follows the philosophy that with a fixed amount of metrics the category that is most important to the customer should be valued the most. Combining this philosophy with the valuation of the customer, on the four point scale with a total of ten points, an overall performance level can be depicted for the supply chain.
3.5. Implications of the new performance measurement framework

This newly developed framework attempts to solve some of the issues associated with PMSs and in specific, supply chain PMS depicted in section 2.2.2. Researchers’ focus on the domain of supply chain measures and metrics, improved remarkably from the year 2000 (Gopal & Thakkar, 2012). Initially, attempts were made to develop integrated frameworks classifying measures; over time attention moved to other areas namely, application of measures, identification of general measures, and measures for green supply chains. This framework aims to employ all of these supply chain areas in one framework.

The framework is composed of a number of diverse measurement categories based upon literature research and own insights. The set of measurement categories that lies at the basis of the framework tries to solve some of the issues associated with earlier frameworks. The set employs both financial and non-financial measures alongside each other, the costs category versus the quality category for example. And it encompasses both quantitative and qualitative measures, the flexibility category versus the CSR category for example. In this way the framework provides an integral visualization of the supply chain and all of its facets of, and relation with the environment and it eliminates the conflicts between the different measures.

The measurement categories are designed to be mutually exclusive and can be distinguished unambiguously. This implicates that conflicts between measures will be eliminated as they focus on different areas. In the case of overlapping categories, one category might have spillover effects to the other categories resulting in an unbalanced categorization. In this case users will always prefer this category over the others. Because of the mutually exclusiveness of the measurement categories the relation between the different categories also becomes less ambiguous (De Tony & Tonchia, 2001). Improving the performance of flexibility will have a negative effect on costs of the system, which in turn may result in less expenditure for CSR.

In line with the previous, the use of the proposed scorecard with a limited amount of points that may be awarded ensures that the user carefully considers the focus points of the supply chain. This gives the supply chain a clear strategy as a whole, resolving issues resulting from inconsistent views within the supply chain. It may furthermore be used to distinguish inconsistencies between the customer’s expectations and the supply chain’s view of the customer’s expectations. This in line with the SERVQUAL model (Parasuraman, et al., 1985), elaborated upon in section 2.1.2.

The problems depicted by Nurmi et al. (2010) are also clearly addresses by the design of the proposed framework. The design of the framework is focused on the integral management of inter-organizational performance measures shared throughout the supply chain. Using the framework the strategy of the supply chain as a whole can be identified and can be managed and developed accordingly. In this way the supply chain may change with the changing demands of the market. The next two sections will elaborate further upon the specific implications of the framework concerning the link of strategic to operational and the consequences on the gaps of the SERVQUAL model (Parasuraman, et al., 1985).

The valuation of the framework also addresses another issue regularly identified in businesses. Often there are irregularities between the vision of the operational and commercial department. For example the operational department is keen on the flexibility of the operations while the commercial department avoids this point in discussion with customers because he thinks they are lacking in this area. This framework may identify these irregularities by comparing valuations of the different employees regarding the company’s core competencies.
3.5.1. Link strategic to operational via tactical

The main focus of this framework is to provide a standardized method to link strategic intent with operational performance. Often the strategy of the supply chain as a whole and associated performance of the different parts of the supply chain are clear but the measures are not in line with the performance they should be focused on (Akyuz & Erkan, 2010). This results in short-term internally focused performance with deteriorating effects on the supply chain as a whole. Therefore the proposed framework connects the strategic outcome driven framework of Melnyk et al. (2010) with a PMS as proposed by Neely et al. (2005).

The strategic aspect of the framework is constituted by the measurement categories. These measurement categories are valued by the customer resulting in a clear strategy for the supply chain. Together the measurement categories form the core of the PMS. Each of the measurement categories is comprised of a number of measures, for example total supply chain costs and lead time, constituting the tactical level of the framework. Each of the measurement categories contains a number of measures high enough to be able to give an integral overview of the performance of the supply chain in the category but at the same time low enough to maintain only the critical few among the trivial many (Akyuz & Erkan, 2010).

3.5.2. SERVQUAL model implications

As supply chains can be seen as service providers they also have to cope with the implications and issues associated with services. The SERVQUAL model (Parasuraman, et al., 1985) as depicted in section 2.1.2 provides a framework that shows the different gaps that result in a difference between the perceived service and the expected service. This customer gap needs to be resolved to result in a high customer satisfaction implicating that the different provider gaps needs to be managed extensively. The proposed framework attempts to resolve each of these gaps using a standardized framework for communication with the customer in expectation mapping, design, and execution stage, resulting in a better fit between service delivery and service expectations.

This framework provides a tool to empower low boundary communication between the supply chain and the customer concerning expectations. The customer is able to visually graph their expectations for the supply chain and creates a starting point for discussion regarding the different performance levels. It also provides intuitive and unambiguous definitions for the different measurement categories which results in less miscommunication reducing gap 1, the listening gap.

The proposed framework provides a well-defined link between strategic outcomes and associated standardized measures. As the customer chooses the strategy and associated measures of the supply chain, the design will be in line with the demands of the customer. By using this framework a standardized method can be used which customer and supply chain agree on which makes the translation of the expectations to design and measures into a standardized process resulting in a smaller design and standards gap.

Following the philosophy what gets measured gets done the framework reduces the service delivery gap. The supply chain manager is better equipped to manage the service delivery as the framework provides the supply chain manager with KPI’s that are in line with the strategy of the supply chain based upon the customer’s expectations. Furthermore it visualizes the strong and weak points of the different parts of the supply chain. The supply chain manager may subsequently manage current, or attract new, third parties into the supply chain to ensure that the expectations of the customer are met.
Each measurement category employs a number of measures which result in an overall performance on the associated measurement category. This overall performance indicator per measurement category can then be compared to the expectations of the customer and provides the user with clear mismatches. If the performance of the KPI’s is directly linked to this model it may provide a communication tool towards the real time performance of the supply chain. This reduces the communication gap as it provides the customer with real time unambiguous performance data that is perfectly in line with the definitions used in the design of the supply chain.

### 3.5.3. Customer orientation

The customer order decoupling point (CODP) represents the point in the material flow where the product is linked to a specific customer order (Olhager, 2012), and is strongly related to the choice make-to-stock, assemble-to-order, make-to-order, and engineer-to-order. Generally speaking the CODP coincides with the most important stock point where the supply chain customer order process starts. The CODP plays a key role in the development and management of supply chain operations, as value is perceived differently upstream and downstream of the CODP. To compete successfully the operations in all the different parts of the supply chain should be aligned with the market requirements of that part of the supply chain.

Figure 10 displays one of the broadly supported theories called leagile (Mason-Jones, et al., 2000; Olhager, 2012; Stevenson & Spring, 2007). This theory is based upon the two paradigms: lean supply chain and agile supply chain. The lean supply chain is associated with a cost leadership strategy while the agile supply chain is associated with differentiation and flexibility strategy. According to the leagile theory the CODP splits the supply chain up into a lean and agile chain, upstream towards the suppliers the chain should be lean and downstream towards the customer the focus should lay on agility.

The implication of the CODP on the supply chain as a whole is the strategy that is developed to be used to develop the tactical and operational level of the supply chain. This framework has been developed to be focused upon the customer demands which will be translated into tactical KPI’s for the supply chain. However these KPI’s may not be the most value-efficient for the different parts of the supply chain. The leagile theory suggests the presence of only one CODP however other theories have been developed suggesting that each flow of materials and products or company may have a CODP. This suggests that it is not possible to identify a supply chain wide strategy but that the supply chain may be divided up into multiple different sub-supply chains, each with their associated customer and strategy.

The concept of sub-supply chains has not yet been extensively explored. However in my opinion it plays a crucial role in the integral management of a supply chain. Each sub-supply chain is comprised by different parties with their sub-supply chain strategy and customer and is not directly involved with the other sub-supply chains. In the development of a supply chain it should be taken into account where to divide the supply chain by employing a CODP. However in contradiction to the leagile theory one cannot state that the sub-supply chain upstream of the CODP should be lean, and downstream of the CODP should be agile. It depends on the customer of that specific sub-supply chain where the focus lies.
3.6. New framework conclusion

In a world where the performance bar is constantly rising, measurement practices must improve at an equal pace. An organization’s attitude towards measurement establishes the focus and boundaries of the measurement system and determines the effectiveness of its efforts to use measurement to fulfill the customer’s expectations and achieve competitive advantage. In this section the development of a new supply chain performance measurement framework is introduced. The framework was designed to follow the rules and tackle some of the issues that are associated with PMSs for supply chains and in general.

Cuthbertson and Piotrowicz (2011) state in their conclusion that supply chain performance measurement should not be considered as a generic context-independent process, but as a system tailored to specific supply chain requirements. This view of context tailored supply chain PMSs lies at the core of this new framework. The framework is developed with a strong customer orientation, as the customer depicts the requirements for the supply chain. Therefore the service that the supply chain delivers should be tailored to the expected service of the customer to close the customer gap identified in the SERVQUAL model as far as possible. This implicates that the expectations of the customer are translated into strategic intent in the five measurement categories that have been identified which in turn can be used to adopt relevant measures.

In contradiction to some other frameworks no effort has been put in assigning definitions as operational excellence to the different blends of outcomes result of the expectations of the customer. In my opinion these definitions are competence oriented rather than customer oriented; “I want to be the most cost-effective supply chain in the market”. However the blend of outcome expectations may be a very specific blend which cannot be put under one of these definitions which would mean that no supply chain is able to deliver the expected service. Furthermore supply chains don’t exist like companies do that have to decide which strategy to follow to attract customers. They are designed and sought together to fit the demands of the customer. This implicates that a supply chain does not have competences as a whole but is context tailored resulting in a specific strategy set. However in the future this might change as logistics service providers are identifying the implications of SCM and are profiling themselves as supply chain managers. They maintain multiple supply chains for other customers and are able to provide the customer with a set of supply chains that are optimized to choose from.

4. Supply chain management design

In this chapter a SCM design will be depicted. This design is based upon the insights acquired during this research. Each of the next sections describes a step that is important in order to attain the successful management of the supply chain. The steps are depicted in order of SCM development level. Section 4.1 elaborates upon supply chain orientation which is focused on supply chains that have just identified the implications of SCM. In section 4.2 the structure of the SCM responsibilities are depicted. Once the organizational structure is in place they may start undertaking supply chain initiatives. Section 4.3 elaborates upon the implementation of the developed supply chain performance measurement framework and section 4.4 on the associated PMS. Finally section 4.5 depicts a number of SCM initiatives that have been identified during this research that may be undertaken by the supply chain managers.
4.1. Supply chain orientation

As soon as a party involved in the supply chain identifies the implications of managing the up- and downstream flows across their supply chain, it can be said to possess a supply chain orientation. Only when multiple directly connected companies possess a supply chain orientation, the identified implications can be managed and implemented. It is therefore crucial that each of the individual parties of the sub-supply chain has identified these implications before investing in SCM. If one of the parties lacks the SCM mind effective SCM is no longer possible as no integral solutions can be implemented. An example of this supply chain mindset is the willingness to share information regarding costs, business models, orders, etc. and to invest time and money in the development of integral solutions. Furthermore the different parties should be on the same page regarding the scope of the sub-supply chain and the definition of SCM. As depicted in section 2.1, SCM may be defined in multiple ways. If one of the parties employs a traditionalist perspective while another party has the perspective of a unionist discussion is guaranteed to lead to failure. It is therefore crucial that the different parties reach consensus regarding the scope and influence area of SCM.

Once the mindset of each party in the sub-supply chain that will be managed is right each company should focus on preparing their company for the inter company management of processes. Companies should migrate from a functional to a process orientation to align all the processes and associated responsibilities throughout their organization. Multiple frameworks have been identified and may provide a good reference point on which a new framework may be structured better suited to fit the developed supply chain measurement framework. Only when companies are able to deploy such a structure within their company, will they be able to successfully deploy it across their boundaries. A crucial step within this migration process is the development of a process map. This process map depicts all the processes that are executed in order to provide the service that the company offers. Process costs and times should be mapped and shared to create understanding throughout the company. This results in the alignment of internal inconsistencies that are identified in the company valuation analysis.

4.2. Structure and responsibilities

Supply chain orientation is described as a management philosophy while SCM is comprised of the activities undertaken to realize this philosophy. Once the supply chain orientation is in place the next step is to develop the management structure that will be responsible for the development and implementation of supply chain initiatives. This structure needs to be developed to manage the supply chain at all times rather than on a project basis as is currently often the case, resolving the lack of a clear point of contact.

Three organizational structures are identified from the literature and discussions with practitioners during this research. The first structure is composed of a single party taking up the responsibility to initiate and manage supply chain initiatives. This structure has as advantages that there is a clear responsible party and implementation possibilities. But there are clear disadvantages in the risk of double agenda’s and lack of knowledge and support of the other parties. The second structure is the employment of an external party to manage the supply chain. The advantage of an external party is the objectivity and knowledge of SCM implications and problems. The disadvantages are the higher costs and lack of knowledge and support. The final structure is a consortium composed of supply chain managers of each of the supply chain parties. The supply chain manager of each of the companies may be a part time responsibility of a current knowledgeable employee. This consortium has as advantage that there is a large knowledge and support base of all the different companies. The consortium will still have a certain risk of double agenda’s and counterproductive behavior and will incur costs because of the time required to discuss among members.
The organizational structure that should be employed is context dependent, each supply chain is designed differently which asks for a different approach. However SCM is teamwork and therefore in my opinion the option of a consortium composed of the supply chain managers of the different companies has the best chance of exploiting the implications of SCM. It has a lot of advantages regarding knowledge base of processes and company specific implications. To exploit the knowledge of supply chain initiatives the consortium may be guided by means of an external party as consortium manager. This external party may have a beneficial effect on the presence of double agenda’s and may provide the consortium with models and frameworks from his experience. Dinalog (2013) is undertaking a similar structure with their LOG2020 project which aims to bring SCM to the boardroom level by bringing together practitioners and researchers to enhance the efficiency of SCM; this supports the use of such a structure within supply chains.

To reduce the risk of double agendas even further a number of aspects may be considered. The members of the consortium should be able to act and decide independent of the result for their respective parties to maintain a clear overall view upon the supply chain. This implicates for example that members should be paid by a budget that is evenly financed by the different companies. Secondly each company should provide the same number of employees to the consortium to reduce the risk of skewed decision making because of the prevalence number of employees of a certain party. And finally a non-disclosure form may be developed to make sure that all the employees are able and willing to share information without the risk of competitive advantages.

Once the structure is set and the responsible members are known throughout the supply chain they will provide a clear point of contact regarding boundary crossing improvements resulting in better performance. The first responsibility of this consortium is to create mutual awareness of supply chain consequences, trust, and transparency. Each party should share all the information to make sure that all the members are aware of the problems and implications of the other parties. In this way the parties will start building trust and will be more willing to share gains and pains throughout the supply chain.

**4.3. Implementation of the supply chain strategy framework**

The supply chain strategy framework provides a tool which can be used to align the strategic intents throughout the supply chain. Each of the parties may use the valuation tool to map their companywide perceptions of customer expectations, measurement, and competencies as is done in this research. These results can consequently be used to guide discussion between the members, and between the members and their companies. In this way all the employees will feel involved in the SCM process. This company wide involvement is crucial for the integral perspective of SCM. Furthermore it makes sure that all the employees get acquainted with the strategic outcome definitions and associated framework which will increase the support for the framework.

Each of the strategic outcomes should be carefully analyzed and discusses to identify gaps in perception and the cause of these gaps. Once these gaps have been identified, the expectations of the end customer of the sub-supply chain should be mapped using the same framework. By using this framework to map the expectations of the customers, the discussions will be better structured along the lines of performance which will have a beneficial effect on the size of gap 1, the **listening gap**. Once the framework is in place, the supply chain will have a supply chain strategic framework on which all decisions can be mapped and communicated to the supply chain and customers. Using the input of the supply chain parties and customer a sub-supply chain strategy can be formulated. This supply chain strategy can then be communicated throughout the supply chain to create strategic alignment throughout the supply chain. This strategic alignment will make sure that all companies work in unison to deliver the expected performance.
It should be noted that mapping the expectations of the customer is a continuous process. The expectations should be mapped initially to identify the initial strategy of the sub-supply chain however the expectations may change during the contract. Therefore it is crucial to use this framework to guide future evaluating discussions as well. The consortium should try to involve the customers to make them aware of the processes that are undertaken to fulfill the service and to make them aware of the consequences.

4.4. Implementation of the supply chain performance measurement system

Once the supply chain strategy framework has obtained a clear position in the integral management of the supply chain aligning the strategic intent the supply chain PMS may be implemented. Because the supply chain PMS is developed using the supply chain strategy framework as basis there is a clear link between the strategic intent and operational performance. Therefore the use of this PMS in collaboration with the framework will align the strategic intent and operational performance which will result in a decrease of gap 2, design and standards gap.

Using this supply chain strategy framework and associated PMS the SCM makes sure that not a single party dictates the measurement programs for all supply chain participants, but rather that all participants take part in developing a well-planned, well-coordinated, supply chain-wide performance measurement initiative to which all can and will be committed. This PMS is designed to be focused on supply chain wide performance rather than individual company performance, in this way the control system does not limit the decision making authority of the managers but promotes mutual advantageous decisions.

The implementation of the individual measures can be described as a simple process of data collection, consolidation, validation, and distribution. All these tasks are all rather mechanistic in nature requiring either new manual or automated procedures to be developed to provide the data that is required. However because of the diversity of companies, the SCM should make clear instructions and definitions which data is required, how these should be measured and how they should be submitted. The implementation of individual measures does not create a PMS; the individual measures should be combined into the measurement categories and evaluated as a whole to assess supply chain wide performance.

The use of this supply chain PMS in corporation with the supply chain strategy framework improves the alignment of strategy and measures. When the strategy of the supply chain shifts towards another strategic outcome, the valuation scorecard will shift the focus towards measures that are in line with the new strategy. In line with the supply chain strategy framework the development of this PMS is a continuous process. The measures that are depicted in this research are broadly applicable and will provide a supply chain with measures that are applicable for a number of years. However they should be continuously reviewed alongside the framework to make sure that they are in line with the strategic intent.

Bourne et al. (2000) identified three main obstacles to the correct implementation of a PMS which need to be taken into account. The first obstacle is the resistance to measurement which is usually caused by the feeling of lack of trust. Managers are easily threatened by new measures and need to be persuaded of the importance of the measures for the company and supply chain as a whole. The measures that are implemented should help the managers make the right decisions rather than hindering them. This obstacle may be resolved by the involvement described in the previous sections and the stepwise implementation of the framework and subsequently measures. This may aid the managers in seeing the bigger picture and the benefits of the PMS.
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A second obstacle is composed by IT-system issues occurring during the implementation of the measures. IT systems are not only becoming an increasingly important part of the business processes as for example warehouse management systems and planning software, they are also crucial for the implementation of the measures. IT solutions are often able to provide managers with reports regarding performance however these reports are often unclear and ambiguous. Furthermore these reports are internally focused which are not useful for the measurement of supply chain wide performance measures. These IT solutions will require investments but will result in lower costs in data collection and analysis.

The final obstacle that was identified was the distraction of the top management during the design and implementation phases. This distraction can be caused by a number of reasons as change of ownership or the acquisition of other companies resulting in the shift of attention to other more pressing priorities. This distraction of top management is mainly possible because of the project approach towards SCM. The implementation of a clear organizational structure responsible for the continuous management of the supply chain will strongly reduce the consequences of this obstacle.

The correct implementation of the supply chain PMS alongside the supply chain strategy framework will provide the sub-supply chain with a new core competence: integral SCM. Measurement shapes behavior and leads to results, so the implementation of supply chain PMS will lead to decision making advantageous for the supply chain as a whole rather than individual performance. This integral SCM may furthermore display itself towards the customer by communication of integral supply chain performance and strategic intent of the entire supply chain towards the customer which will give them a big competitive advantage towards competitors who state that they are carry out supply chain solutions.

4.5. Supply chain initiatives

The implementation of the supply chain strategy framework and associated supply chain PMS is only one of the initiatives that may be undertaken. As identified in this research SCM encompasses three flows that need to be managed separately as well as integrally: physical, financial and information. In this section a number of initiatives will be depicted that have been identified during this research and may be executed to improve the performance in these flows.

One of the low end supply chain initiatives that may be undertaken is the management of information regarding forecasts. The benefits of such a practice have been extensively depicted in the supply chain literature. The benefits are mainly focused on reducing the bull-whip effect, which can be described as a trend of larger and larger swings in inventory in response to changes in demand. Services however are not able to stock inventory, but are able to increase and decrease capacity of their service. Therefore the integral management of information regarding forecasts will also reduce the effects of the bull-whip effect on the service providers and will make the supply chain leaner.

A second supply chain implication lies in the integral mapping of the processes. All the different process maps may be collected and analyzed to gain insight in the processes each company executes to deliver the product to the end customer. When this integral process map is depicted a number of improvement options may be identified. Redundant processes may be deleted to shorten the lead time and reduce costs and administrative tasks. Links between the different entities may be redesigned to reduce errors and speed up the process. Processes may be identified that may be repositioned towards another position in the supply chain. And finally responsibilities may be assigned for certain processes that lack a clear management.
5. Tool design

To make efficient use of the proposed framework an Excel tool has been developed to assist users in making tradeoffs between the different categories of the framework following the 10 point valuation method. This provides the user with a clear visualization of the division of points and facilitates efficient communication regarding the strategy of the supply chain both with customers as with supply chain partners. Figure 11 displays an overview of the measurement tool and its dimensions.

- **Company**: this dimension addresses irregularities between the visions of employees on the core competences of the company. It may furthermore be used to identify differences between the vision of the company and others regarding company or supply chain performance.
- **Customer**: this dimension aims at gap 1 of the SERVQUAL model by identifying the expectations of the customer. This dimension can be valued by a customer to visualize its expectations or by supply chain parties to visualize management perception of the expectations of the customer.
- **Measured**: the final dimension aims at the lack of connection between the strategic intent and currently employed measures as depicted by gap 2 of the SERVQUAL model. It may be valued by both supply chain parties and customers and will visualize the differences between measurement perception and the lack of connection between the strategy and measures.

The tool includes a database which stores the input provided by the user. These valuations can later be retrieved using the view userinput function. In this way users may share their valuations with others and they may be used at a later time to analyze changes in behavior. This database also provides the user with the possibility to compare users on the different dimensions that they have valued. For example the director of a company may compare the scores of the commercial and operational departments on the company dimension identifying possible irregularities.
The initial use of this tool will be the structuring of discussion regarding performance measurement in the supply chain, both with other supply chain parties as with customers. When the tool is extended to include the context specific KPI’s that may either be required by the customer or depicted by the supply chain it may be used as a communication means towards the customer regarding the performance of the supply chain. In this way the customer can get an objective view of the performance of the supply chain and can be used to focus discussion on the areas that need attention decreasing the communication gap.

6. Business case

This research will be executed for and under the guidance of the Nabuurs Logistics division on behalf of Operational Director Tjebbe Nabuurs. This division is specialized in integral supply chain solutions. The aim of these solutions is to identify the best approach for the customer’s products, in terms of costs, service, and sustainability. To do so Nabuurs Logistics develops and implements integral supply chain solutions and is also able to execute the administrative and IT-based tasks related to the management of the supply chain. From this point of view Nabuurs is interested in the possibilities of SCM in the supply chain of Unilever which they are active in. Appendix E: Supply chain scope visualizes the total supply chain and the scope of business case represented in this thesis illustrated by the dotted ellipse.

6.1. Supply chain scope

In this business case one of the sub-supply chains of the whole supply chain of Unilever frozen ice-cream is analyzed. Unilever owns a number of ice-cream brands including Ben & Jerry’s, Hertog, and Magnum after Dinner ice-cream and is responsible for the contact with the end-customer of the supply chain. The Unilever Supply Chain Company (USCC) is a stand-alone entity that has been established to act as the Centre of Supply Chain organization in Unilever. It is responsible for the entire sourcing, production, and logistics processes in Europe. The USCC acts as a supply chain manager by managing the whole factory network and the correct outsourcing of warehousing and transport. This results in a very specific supply chain in which no process-related responsibility can be assigned as USCC is the direct employer of the different parties in the supply chain, but Unilever is the point of contact towards the end-customer. Furthermore the products remain the property of Unilever and USCC in contrast to other supply chains in which ownership transitions can be identified.

The sub-supply chain under research is located near the end of the supply chain at which point the products are completely fabricated and packed onto pallets located at Partner Logistics in Bergen op Zoom. Partner Logistics was established in 1998 as a response on a tender for an automated cold store for Lamb Weston. This tender was won in 2000 and in 2002 the first phase of the cold storage facility in Bergen op Zoom was finished. Partner Logistics is specialized in the construction of automated warehouses in order to provide the customers with higher service levels, optimal food safety environment, improved inventory management, and limited manual interaction. After the initial phase, Bergen op Zoom’s storage facility has been expanded with an additional three phases providing a total of 178,500 pallet places.

Unilever uses the cold storage facilities of Bergen op Zoom in order to store both raw materials as finished goods. Raw products are stored for transport to the production facilities, while the finished products are stored for transportation to the Dutch and Belgium market. Partner Logistics fills buffer channels from which the trucks can be loaded. The truck pulls up to the assigned dock within the assigned time window after which it is loaded with the pallets associated with the order by forklifts. The next step in the supply chain is the transport of the frozen goods in conditioned trailers from the warehouse in Bergen
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op Zoom to the customers of Unilever throughout Belgium. Nabuurs is responsible for the efficient execution of this process. The Belgium market is rather sparse and asks for a specifically designed transport planning system. The transport planning system employed by Nabuurs can be specified as a hub and spoke system. Using central hubs and a fixed number of trucks stationed at these hubs.

The end-customers of this sub-supply chain are constituted by the distribution centers of the different European supermarkets as for example Carrefour. The distribution centers are responsible for the supply of a wide range of products to different supermarkets. Therefore the stock of these distribution centers is rather low and they need to be restocked regularly with small quantities. Because the market of ice-cream is very seasonal the supply chain needs to be managed accordingly. In the winter season the supply chain should be able to cope with the build-up of stock and sporadic deliveries. While in the summer season the supply chain should be able to cope with high volumes and should deliver high flexibility.

7. Interviews

Because of the extraordinary nature of the design of the supply chain the choice is made to qualitatively analyze the supply chain and validate the developed framework. This qualitative analysis will be done using unstructured interviews which will be guided along three topics:

- Supply chain management
- Framework validation
- Supply chain management business case

The questions will slightly differ based upon the interviewee but a general overview of the questionnaire can be found in Appendix C: Interview structure. To obtain a diverse base of feedback interviews will be executed among employees of all three companies involved in the supply chain: Partner Logistics, Nabuurs, and Unilever. The list of interviewees has been set up as a result of discussions and meetings with key persons. This has resulted in the following list.

**Partner Logistics**
- Eelco Schnabel Commercial director
- Simon Verburg Manager Operations
- Tonny Bracke Site manager
- Peter Bryssinck Planning manager

**Nabuurs**
- Marloes Oostendorp Business development
- Joop de Hoog General manager Belgium
- Tjebbe Nabuurs Operational director

**Unilever**
- Erik-Jan Helderop Customer service and logistics manager Netherlands
- Jose Marques da Silva Customer service and logistics manager Belgium
- Jannie van Andel General supply chain manager
7.1. Supply chain management

- SCM material focused but supported by financial and information flows.
- Horizontal collaboration does not fall within SCM.
- Mutual transparency and trust is crucial for effective SCM.
- PMS closely related to strategic intention and therefore crucial.
- Not clear whether the strategy should be customer or competence based or a combination.

The ambiguity of the definition of SCM that arose from the literature study is partly reflected in the ability of the interviewees to define SCM. Most of the definitions that were given are in line with the definition that was developed in the first part of this report, regularly using the saying “Van zand tot klant” translating into “From dust to customer”. This saying can be described as the management of all the processes that are performed to transform dust towards product and the delivery of the product on the doorstep of the customer, implicating that SCM incorporates more than just logistics.

Some respondents stated that SCM is influenced by the area that the manager has influence on. This results in a scope that merely exists of the focal company which implicates that the focus lies on internal performance rather than supply chain wide performance. This statement substantiates the observation that the scope described in the actual function description in the business environment is often too narrow to be concerning SCM.

One of the respondents touched upon another issue elaborated upon in the supply chain literature analysis. Section 2.2.2 states that because of the lack of connection between the SCM research area and the business environment a lot of models supported by the scientific area do not find their way into business practices. The respondent substantiates this and states that SCM is currently in the transformation from scientific towards business practices. So far models have not been implemented because companies lack the tools and knowledge to do so.

During this research the term horizontal SCM was often mentioned. Horizontal supply chains can be described as the companies that work alongside each other performing the same activities but for example for a different market. A real world example is constituted by Partner Logistics as the spider in the web from and towards which many different transporters transport products. Partner Logistics may consolidate all these flows and manage them to improve the efficiency of the entire flow in the web of Partner Logistics. The existence was questioned in the interviews and the results were clear; horizontal SCM should be called horizontal collaboration management.

The question whether effective SCM is possible despite the differences in management and processes of the parties in the supply chain proved to be a bit ambiguous. However after a short discussion regarding effective SCM and the differences between the parties the respondents provided some requirements for effective SCM to be possible of which trust was one of the main pillars. Trust needs to be built from the relation between the supply chain partners and if trust is in place transparency comes into play. Transparency will provide the different parties with insight into the processes and business model of the others which will pave the way for SCM and a better supply chain performance.

All the respondents agreed upon the point that measuring the right aspects is crucial for the performance of each business unit and therefore also for the supply chain as a whole. It was noted by one respondent that usually the focus externally is skewed towards quality while internally the focus is skewed towards cost reduction. This implicates that the metrics are often not in line with the strategic intent of the supply chain which has been identified as one of the main issues with PMSs. Another respondent took a
similar stance stating that performance measurement makes sure that all the noses are pointing in the same direction substantiating the three roles of performance measurement.

The final subject of the general SCM topic dealt with the orientation of the supply chain as a whole, whether it should be customer or competence based. Businesses are currently focused on developing and maintaining their core competencies to outclass the competition or to distinguish themselves in the market while the core of the developed framework is that the supply chain is already in place and the sole purpose should be to conform to the expectations of the customer. This indistinctness is substantiated by the responses of the interviewees whether the supply chain should be customer or competence based and some even stated that it should be a combination of both. The combination of both can be depicted as following: you should always conform to the expectations of the customer however, as often is the case with new product development products, customers do not always know what they want. Therefore supply chains should identify possible initiatives and implement them to form competencies which may form a crucial competitive advantage and become a market expectation for this type of service from that point forward.

7.2. Framework validation

- Dominant measurement category is quality, with costs and flexibility strong seconds.
- Corporate social responsibility is emerging.
- Innovation is rather ambiguous.
- Framework is all including.
- Dominant metrics are on time delivery and tariff.
- Activity based costing hardly ever works
- Framework and tool could be useful if correctly implemented.

In the second part of the interview a number of questions were asked regarding the developed framework. The first question was what the respondents think what strategic outcomes customers assign value to. Every interviewee responded with quality as one of the key categories, typically describing quality as the delivery of the right product at the right time at the right place, making it the most dominant metric. Some extended the scope of quality to also include lead time and customer satisfaction in regards to communication and service. This quality category is in line with the insights acquired during this research which denoted that the supply chain can be seen as a service of delivering the right product at the right time at the right place. Furthermore quality is one of the most dominant aspects depicted in the literature analysis into measurement categories. One respondent also stated that the customer is not interested in the working of the supply chain only the end result.

Two other aspects that were frequently mentioned are flexibility and costs. Flexibility, or responsiveness as some respondents named it, was depicted as the ability to respond to unexpected circumstances as for example rush-orders and extreme weather conditions. The costs description was more ambiguous as tariffs are often set regardless of the costs of the supply chain. Therefore it was less often mentioned as one of the categories on which the customers focus. Finally one respondent mentioned the upcoming awareness at the customer side of the supply chain on environmental matters, combining environment and the other categories in the three C’s: carbon, customer service and costs.

The fact that costs, quality and flexibility were mentioned by almost all the respondents justifies the presence of these measurement categories in the developed framework. It furthermore justifies the choice for the names and definitions of these categories and provides belief that the framework has a base of
support in a business environment. However it proved to be difficult for some of the respondents think beyond the obvious expectations of the customer and think about the bigger scope of a supply chain which may have resulted in the lack of notion of CSR and innovation as topics. Therefore a discussion was started concerning the different strategic components of the developed framework. The respondents were given the definition depicted in section 3.2 and were asked to respond upon the definition.

The first category that was discussed is quality. As was already clear from the initial question regarding customer’s expectations the respondents have the same vision regarding the definition of quality as the framework. However some found the term quality still a bit ambiguous as quality may also encompass measures of flexibility and innovation. This implicates that quality might be an umbrella term which is to broadly used. However other terms as customer satisfaction and service have the same problem. Discussion regarding the individual metrics of which the measurement category is comprised resulted in consensus with all the respondents that these metrics should be grouped together.

Cost was the second category to be discussed. In the initial question a lot of the respondents mention costs as being crucial however none could depict the exact definition of what this category should measure and end up with the price a customer has to pay for the service, tariff. The tariff of the supply chain service is not directly related to the costs of the supply chain and therefore provides an ineffective metric, however it is the only metric the customer is interested in. This is in line with was mentioned earlier that at this moment the customer is not interested in the working of the supply chain but only in the end result. The division into process costs, inventory costs and overhead costs is substantiated by the respondents. Process costing on the basis of activity based costing however is very ambiguous and it has proven to be very hard to make the translation from the scientific model to a business environment. Finally it became apparent from the interviews that companies find it hard to talk about costs with customers.

The third category that was discussed is flexibility. There was a large consensus among the respondents regarding the division of flexibility into operational, short term, and market, long term, flexibility. An example of operational flexibility was given by one of the respondents in which the supply chain was able to deliver a rush order within 6 hours. The respondents indicated that discussions with customers about the long term growth of business were undertaken, implicating the presence of long term flexibility.

Innovation is the fourth measurement category and was not depicted by any of the respondents in the earlier question and may therefore be indicated as a secondary or even redundant category. Customers will advocate for these kinds of secondary measures but only if it yields them a benefit. It can therefore be seen more as a mean of the supply chain than a goal. However two respondents indicated that there are companies that identify innovation as part of their strategy and therefore see it is a pre of a supply chain, this implicates that it might be context dependent whether innovation is a goal or a mean. Nonetheless most of the respondents agreed upon that innovation is an indicator of long term commitment and endorsed the different metrics that are depicted under the measurement category innovation.

The final measurement category that was discussed is CSR. Similar to the innovation category, CSR is denoted as a secondary factor. CSR and especially environment measures have been exploited to boost the image of companies while the main driver behind the changes was cost reductions. The interviewees however do notice an emerging trend towards social awareness on the part of the customers. Consumers no longer close their eyes to things that happen in the supply chain of their product, as for example the production facilities of Apple. Some respondent mentioned that hardly any customer brings up the subject of social corporate responsibility but do identify the implications and are hoping the supply chain will take act on own initiative.
One distinction that was often made by the respondents was between qualifiers and order winners. In the tendering process an overview is made of the expectations of the customer for the service of warehousing or transport. These expectations are the qualifiers of the tender, which means that as a company you have to be able to achieve or exceed these performance indicators. If the company is able to perform up to these standards they may participate in the tendering. In the tendering process customers will discuss with possible service providers to find the best match regarding the order winner abilities of the companies. Order winner qualities are often depicted in the categories flexibility, innovation, and CSR. However opinions differ between the respondents whether a category is a qualifier or an order winner which implicates that it is probably customer dependent.

The concluding question of this topic was focused on the comprehensiveness and usefulness of the developed framework. None of the respondents were able to mention any aspects that were not encompassed by the developed framework and praised the research and associated framework for its comprehensiveness. The inclusion of the two secondary categories is disputed because they may not prove to be genuine goals and expectations of the supply chain. Initial use of the framework in discussion with actual customers could provide input whether customers are willing to trade-off other measurement categories for these secondary categories. Furthermore the respondents see potential in the framework and associated tool if properly implemented in the supply chain. It would provide the operational department with a clearer view on the performance and the commercial department with a useful tool to communicate this performance towards the customer. Furthermore it reduces ambiguity and increases the effectiveness of the communication within the supply chain and individual companies.

7.3. Supply chain management business case

- Different opinions on the presence of process view.
- IT not capable of boundary spanning supply chain solutions.
- Clear link between functions and SCM but no clear responsibility.
- Not clear whether the supply chain is being managed or not.
- Nabuurs not in the position to fulfill the role of supply chain manager.
- Partner Logistics may fulfill the role of sub-supply chain manager.
- Unilever may be in the best position to fulfill the role of supply chain manager.
- An external party as supply chain manager has more disadvantages than benefits.
- Joint venture organization overall best solution.

The final topic focuses on the business case of this research, by discussing a number of questions regarding the current and future state of the supply chain. In section 2.1 the importance of process thinking for efficient SCM is depicted. It is therefore important that the different supply chain parties adhere to a process view throughout the companies executing the service. In this business case Partner Logistics and Nabuurs are performing the processes of the service while Unilever has an overarching role in the supply chain. Therefore employees of Nabuurs and Partner Logistics were asked whether their company employs a functional or process view. Furthermore the existence of a boundary spanning IT solution was discussed, in other words whether the current IT software is capable of handling boundary spanning supply chain initiatives.

At Partner Logistics the operational department agreed that the company employs a process view. The organogram can be built up taking the processes as a basis. However the commercial department was of the opinion that the company employs a functional perspective. This respondent stated that a project called
“our process” has been conducted to map the value adding processes and the operations are focused around these core activities however the organization is still functionally organized. On the part of IT the opinions were also divided. The general opinion was that the currently employed IT solutions are mainly internally focused and does not provide tools to communicate with external systems or provide insight to customers into their order handling. However one of the respondents stated that the IT theoretically could be further developed to be able to cope with extensive SCM as it is being upgraded.

All the respondents of Nabuurs agreed that Nabuurs as a group is functionally oriented with its overhead functions however the operational end of Nabuurs is strongly process oriented. One respondent stated that this process orientation mainly resides in the heads of the employees which has a negative impact on the standardization of the processes and supporting structure. However another respondent stated that each process is carefully mapped along with their associated costs and lead times, which implicates a lack of communication regarding process mapping. Concerning the IT of Nabuurs the respondents agree that it is mainly internally focused with only indispensable links to external systems. However according to one respondent it is currently upgraded and may be made compatible with other external systems. A standardized IT solution should be in place within Nabuurs and customer specific solutions need to be implemented to communicate with the IT software of the customers and supply chain parties to make the IT supply chain management ready.

Each of the interviewees was asked to describe the relation between their function and their definition of SCM. From the responses it was clear that every function was in one way or another influenced by SCM, implicating the integral nature of SCM throughout companies. But only a few respondents clearly felt the responsibility to act upon supply chain initiatives, or knew who to contact in case they identified supply chain possibilities. When the respondents were then asked whether the supply chain is currently managed or not a similar conclusion could be drawn. Some of the respondents did feel the responsibility to act upon supply chain implications that were identified however they often find themselves in lack of support for such initiatives at the supply chain partners. Because it is not clear to the respondents whether the supply chain is being managed or not, one may assume that the supply chain is currently not being managed. It became clear from the discussions that the main problem arises from a lack of structure and division of responsibility. Occasional boundary spanning initiatives are undertaken but no integral supply chain structure is present which results in a further lack of responsibility and effective management.

The final question of this topic was regarding the optimal structure of SCM responsibilities. In this discussion three organization forms were discussed: a single supply chain party takes up responsibility, an external party manages the supply chain, and a joint venture construction composed of all the (sub) supply chain parties. Regarding the single party construction most of the respondents agreed that this would not work as SCM should be a boundary spanning activity and the companies would lack trust in each other to deliver the needed information and the risk of double agendas. Furthermore difficulties arise in the form of pain and gain sharing as one company will make all of the managing costs while benefits may be yielded elsewhere. The position of Unilever as overarching company with power in this sub-supply chain does provide them with a good basis to fulfill such a role but the risk of double agendas is still present. Furthermore there exist the risk of initiation from an authoritarian point of view which will hinder effective SCM. One respondent of Nabuurs argued for Partner Logistics for taking up this responsibility as there are examples in which they collaborate with a warehouse operator to share information regarding costs and provide a single all-encompassing service to the customer. In this situation there are clear incentives to manage the supply chain integrally.
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The second construction was depicted as the use of an external party. An external party that would be financed by all the sub-supply chain parties has as an advantage that he would reduce the risk of double agendas and may employ supply chain knowledge from other supply chains. However the respondents were clear that there is a big disadvantage towards an external party as he will have no knowledge of the processes and organization of the supply chain parties, which is crucial to the efficient management of boundary crossing initiatives and process alignment. Furthermore an external party will most probably be more costly and find a lack of trust and support base as often happens with consultants.

The final organization form is comprised of a team of members formed by employees of the different sub-supply chain parties. This form was preferred by most of the respondents because of the knowledge level of the organization and processes throughout the supply chain. However the risk of double agendas is still present which will hinder the effective management of the supply chain as a whole. One respondent noted that this team of employees should be independent of the result of their respective parties to maintain a clear overall view upon the supply chain. This implicates that the use of a team comprised of employees would provide the best development and implementation of supply chain practices however the barrier of open communication should first be reduced.

8. Framework valuation analysis

This chapter will elaborate upon the insights acquired from the valuation of the framework by the different respondents. The tool depicted in section 5 was introduced during the interview and the respondents were asked to value the different measurement categories on the different dimensions. This valuation was done following the discussions regarding the framework and the definitions of the different measurement categories were therefore clear. The valuations provide insights in a number of aspects which will be elaborated upon in the following sections.

8.1. Company vision

This section will focus on the irregularities between employees regarding the strong and weak points of their company. A graph will be plotted in which the different employees of that company are depicted. This analysis will only be performed on the companies Nabuurs and Partner Logistics as Unilever’s role is overarching and they do not perform actual value adding processes.

8.1.1. Partner Logistics

Four respondents have valued the strong and weak points of Partner Logistics, one employee of the commercial department and three employees of the operational department. The results of their valuations are visualized in Figure 12. A number of things can be concluded from this comparison. First of all the respondents agree upon the good performance of Partner Logistics on the measurement category quality. This implicates that they have a rather short lead time, have a low number of incorrect or late order deliveries, and maintain a good relationship with their customer. A similar consensus is present on the costs measurement category resulting in an above average performance. There is also consensus regarding the topic of CSR but on a very low score, implicating that CSR is not an important topic at Partner Logistics at this moment.

The interesting subjects however are the measurement categories in which there is not a clear consensus: flexibility and innovativeness. On the topic of flexibility one respondent stated in the interview that the implementation of buffers in the warehouse system and the 24/7 philosophy of the site are critical
indicators for the flexibility of the company valuing it with 3 points. However two respondents valued Partner Logistics with only 1 point in regard to flexibility, they argued that because the warehouse is fully automated it is not able to respond to large changes in volume or orders. They also noted that the buffers provide flexibility in volume per hour but not in operations regarding late arrivals of transporters and may even hinder operations. On innovation a clear difference is present between the operational department with 2 points and the commercial department who score Partner Logistics with 0 points. These inconsistencies in view may be present throughout the company which may result in miscommunication and lower performance.

8.1.2. Nabuurs

Three respondents have valued the strong and weak points of Partner Logistics, the functions of these respondents cannot be clearly divided up into commercial and operational responsibilities because of the process orientation of Nabuurs. The results of their valuations are visualized in Figure 13.

The valuations of the Nabuurs’ respondents show a clear disagreement on the competencies of the company regarding the measurement categories, except for innovation. The respondents agree upon a score of 1 on the performance of Nabuurs in the innovation category, implicating that not much effort is put into developing innovative new processes and products. On the measurement categories costs and flexibility two respondents agree upon a score of 2. The third respondent has valued these categories with respectively 3 and 1 points. This one point difference of 1 respondent does not raise concern as it may be caused by a small difference in opinion regarding a single metric of the category. However because of the small range of the framework it may be still be worth discussing to address possible differences in opinion.

The categories quality and CSR are more interesting because the values differ up to 2 points. One respondent clearly favors the performance of Nabuurs on quality rather than CSR scoring a 4 and 1 respectively. The second respondent conveys the opposite valuing the performance on quality with 2 points and on CSR with 3 points resulting in a difference of two points with the other respondent. The third respondent is of opinion that the golden mean is true with a valuation that averages the other two respondents’ valuations. This difference implicates that the different employees are not in line which may result in expectations towards the customer that cannot be translated into actual performance. It also indicates that the expected strategic outcome is unclear which may result in inconsistent decision making.
8.2. Customer expectations

In this section the valuation of the customer expectations are analyzed. The respondents were asked to value the different outcomes on their perception of the importance of the customer. To maintain an organized view the valuations are grouped and analyzed per company visualized in figure 14, 15, and 16.

8.2.1. Partner Logistics

The graph of Partner Logistics shows a clear consensus, Figure 14. The three measurement categories that have been depicted as primary; quality, costs, and flexibility, receive a relatively high score from each of the respondents compared to the two secondary categories; CSR and innovation. This is in line with the conclusions from the interviews that customers are mainly interested in the primary categories and if these qualifiers are met secondary topics come into play as order winners. It is interesting to note that the commercial department has valued both secondary categories with 0 points while the operational department does assign value to them. One would assume that from a commercial point of view these categories would be an image booster and are point of discussion with customers while the translation towards operational procedures is hardly ever made. If this figure is compared with Figure 12, Company valuation Partner Logistics it can be concluded that the competences and focus of Partner Logistics are in line with their perception of the expectations of the customer.

8.2.2. Nabuurs

In contrast to the graph of Partner Logistics, Nabuurs does not reach a clear consensus regarding the customers’ expectations, visualized in Figure 15. One respondent clearly favors quality above the other categories, in which the other two primary categories costs and flexibility score slightly higher than the secondary categories. This implicates that the focus should still lie on the primary categories but quality of the service is of upmost importance. The other two respondents are of similar opinion scoring quality significantly lower and favoring costs over the other.
categories implicating that the price a customer needs to pay the service is of more importance than the reliability and timeliness of the service. These two respondents assign equal amounts of value to the secondary categories implicating that these may be of equal importance as the primary categories.

8.2.3. Unilever

As depicted in section 6.1 Unilever is the main point of contact towards the end customer of the supply chain, therefore we may assume that they have the best insight in the expectations of the customers. Figure 16 visualizes the valuations of the customer service and logistics managers of the Netherlands and Belgium. Even though Belgium customers are very different to Dutch customers this graph shows a clear consensus on customer expectations. Quality is of upmost importance with a valuation of 4 closely followed by flexibility with a score of 3. The other three categories receive a score of 1 implicating these categories are discussed but do not form a crucial aspect of the customers’ expectations as the other two categories.

8.2.4. Customer expectations conclusion

As becomes clear from the graphs visualized in this section clear gaps in perception can be identified. Because of the role of Unilever as point of contact towards the customer they are responsible for the management of this gap. The fact that the two respondents of Unilever valued the different categories identically provides some prove that this gap is rather small. However because it only considers two respondents and is not cross-referenced with the valuations of customers it is only presumption.

Another conclusion can be drawn from the differences between the customer expectations of Unilever and the two logistic service providers Nabuurs and Partner Logistics. Apparently the expectations of the end customer of the supply chain do not find their way to the service providers resulting in a large design and standards gap. The respondents do agree upon the importance of quality for the customer but on costs the opinions vary significantly between Unilever and the service providers. This is probably caused by the fact that Unilever acts as intermediary between the customer and the service providers. Unilever sets a tariff for the customer and subsequently tries to increase its margin as much as possible by emphasizing costs in the supply chain. This attitude results in behavior that is not in line with the expectations of the end customer of the supply chain which may result in misguided decision making.

8.3. Performance measurement

The third dimension that the respondents valued the framework upon is how they are measured. As depicted in the previous chapters Unilever fulfills the role of control tower and link between the customer of the supply chain and the different service providers. Because of this role they are responsible for the development of measures for the PMSs of the service providers. Therefore the valuations of Partner Logistics and Nabuurs in regards to measurement, visualizes how Unilever translates their expectations into measurement.

8.3.1. Partner Logistics

A number of things become clear when analyzing the results of the valuation of measurement by Partner Logistics (Figure 17). All the respondents agree that there are metrics in place that measure the performance of Partner Logistics regarding quality. The existence of the customer case fill on time metric has been substantiated by all the respondents in the interviews. However this metric is only measured at the final stage of the supply chain: the delivery of the product to the customer and is not reverse
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engineered into performance of Partner Logistics. At Partner Logistics the main metric used for quality is the percentage of orders they are able to fulfill within the associated time window. This metric has a clear relation with the supply chain metric CCFOT at the end customer but it is not perfectly aligned with the focus of the supply chain as a whole. A simple example suffices: when a Nabuurs truck is late Partner Logistics cannot be held responsible for not making the associated time window and the order is therefore not incorporated in the performance of Partner Logistics and is postponed if other trucks are on time. This often results in extra delays while the order may have still been on time if the order was processed immediately. This example shows that while the metric has a relationship with the strategy of the supply chain as a whole but a more integral metric would benefit the overall performance of the supply chain.

Comparing Figure 17, measurement valuation, with Figure 14, customer valuation, a clear resemblance can be identified. The focus is laid upon quality and costs while innovativeness and CSR are of less importance. However flexibility does differ between measurement and customer expectations. This implicates that while the customer expects a high flexibility performance of the supply chain Partner Logistics is not extensively measured upon this category. Comparing Figure 17 with the customer expectations of Unilever (Figure 16) an interesting difference can be distinguished in terms of costs. While costs are of no significant importance for the end customer of the supply chain Partner Logistics is extensively measured upon costs by Unilever. This provides proof for the existence of gap 2 of the SERVQUAL model, failing to translate strategic intent to operational performance through tactical metrics.

8.3.2. Nabuurs

As with Partner Logistics the emphasis of measurement lies upon the performance in the quality category (Figure 18). In contrast to Partner Logistics, Nabuurs is being measured upon the supply chain quality performance metric CCFOT. However the range of values on the other measurement categories is quite broad, implicating that there is no clear consensus on what is being measured. As stated in section 2.2; measurement creates understanding, shapes behavior, and leads to result. If there is no clear consensus on what is being measured this may result in deteriorating performance as employees make counterproductive decisions.

This lack of consensus is in line with the valuation of customer expectations in Figure 15. This substantiates the view of Nabuurs that the performance of the supply chain should be focused on the expectations of the end customer. This view is shared with Partner Logistics depicted in the previous section. This implicates that the strategic intent of the supply chain should be reflected in the PMS to shape the behavior of the companies in the right direction.
8.3.3. Performance measurement conclusion

The purpose of performance measurement has been depicted as to link the strategic intent with operational performance following two of the three roles: shapes behavior and leads to results. This implicates that the metrics that are measured should be perfectly aligned with the strategic intent of the supply chain as a whole closing the design and standards gap. And this strategic intent is in turn developed on the basis of the expectations of the end customer. Because of the inconsistencies in especially the measurement of Nabuurs nothing can be stated on the differences between what the customers actually want and what is being measured. Therefore the existence and size of this gap cannot be identified using these graphs. An extensive research into the actual reports that are delivered towards the customer should be studied to come up with the correct results of what is being measured.

When comparing Figure 17 and Figure 18 with the customer valuation of Unilever in Figure 16 some interesting aspects stand out. One of the respondents of Nabuurs depicted that they were being measured exactly as the customers’ expectations that were depicted by Unilever. In this case the strategic intent is perfectly in line with the tactical measurement, and following the roles of performance measurement this in turn would lead to performance. This is the situation where supply chains should aim for. A second aspect that needs to be noted is that the valuation is mainly skewed by the influence of the cost category. Apparently some of the measurements are still cost oriented while this is not in line with the expectation of the end customer. This is probably due to the role of Unilever who want to increase margin which is reflected in discussions with the service providers.

9. Business case recommendation

Following the supply chain design in section 4 and the insights accumulated from the interviews and valuations, this section elaborates upon some recommendations for the business case. It will be guided along the same lines as used in the general design of SCM, starting with the individual supply chain orientation of the different parties, followed by the identification of the organizational structure. When the structure is in place the developed framework and performance measurement may be implemented alongside other supply chain initiatives.

9.1. Supply chain orientation

From the interviews it becomes clear that the definition of SCM corresponds between the different employees and supply chain parties. In section 4.1 it has been depicted that it is crucial to be in the same paradigm to avoid miscommunications regarding supply chain initiatives. In the interviews it also became clear that the scope of SCM depends on the area of influence of the supply chain manager. This implicates that the scope of SCM is not yet clear and should be evaluated to come to an unambiguous scope for SCM in the chain. Finally the interviews identified that there is no clear consensus regarding the process view. The same can be concluded from the differences in valuations within the company. It is therefore crucial that the supply chain parties first employ a process view, map the process, identify the core competences of the company, and assign the internal responsibility for SCM.
9.2. Structure and responsibilities

As was stated by one of the respondents the first supply chain initiative should be focused on the organization of SCM rather than the implementation of operation supply chain initiatives. In this way the problem of lack of responsibility and clear point of contact identified in the interviews will be solved. The interviews have shown that practitioners favor the structure of a consortium comprised of all the parties for the integral management of a supply chain over the use of an external party or a single company. The favorable position of the consortium is due to the crucial role of teamwork in SCM and the knowledge base of the processes and implications of the different companies. Therefore the different parties should initiate a discussion regarding the time and budget of the consortium and subsequently assign employees with the responsibilities of supply chain manager of that company. The management of the supply chain will probably not be a full time function for each of the members and therefore the consortium may make arrangements to hold a weekly or bimonthly meeting to discuss, implement, and evaluate supply chain initiatives.

The respondents were also clear that the lack of knowledge and support of an external party would only hinder the effective management by such a party. However in my opinion it could provide a number of benefits to the management of the supply chain if an external part is involved in the consortium as elaborated upon in section 4.2. The external party could fulfill the role as mediator because of his unbiased view and as a result further decrease the effects of double agendas. A second disadvantage of an external party that was identified by the respondents is the high costs. Because he is part of a team the number of hours per member could be reduced, lowering the costs. Furthermore this party could be paid a margin per total supply chain cost reduction or quality increase to make sure that there are clear incentives.

9.3. Implementation of the strategy framework and performance measurement system

The interviews showed that companies find it hard to discuss costs with customers. By using this framework in combination with the measurement system the cost factor will become less intangible to the customer which will make it easier to discuss costs. However because of the current process in which a tariff is set at the start of the contract, the customer has no incentive to contribute to the reduction of costs throughout the supply chain. Therefore efforts should be undertaken to provide the customer with clear incentives regarding the performance and costs of the supply chain. The use of clear process costing and lead times that have been depicted in this section will aid the supply chain consortium to communicate these factors with the customer. The valuations furthermore show that the expectations are not clearly distributed throughout the supply chain resulting in a lack of alignment of performance. The framework should therefore be implemented to guide discussions between the supply chain parties.

The successful implementation of the supply chain wide PMS is not yet within reach of the supply chain under investigation. The completion of the previous steps will probably take a considerable amount of time and effort and will accommodate the implementation of the PMS in time. However the different supply chain parties may use the performance measurement categories and associated performance metrics in discussions regarding the operations to make the first steps towards the alignment of strategic intent and operational performance. When the strategic framework has acquired its place within business practices the SCM may take the next step by implementing the PMS.
9.4. Supply chain initiatives

The respondents stated that a lot of the IT solutions are mainly internally focused and are not capable of seizing the implications of SCM. Therefore IT solutions need to be developed to be able to collect reliable data per company and consolidate the data to provide the consortium with a clear overview of the supply chain wide performance. These IT solutions should furthermore accommodate further collaboration between the supply chain parties. One practical example of a process improvement using IT solutions which could be depicted from the interviews lies at the link between Nabuurs and Partner Logistics. It would be beneficial to the supply chain as a whole to employ an IT solution to make paper handling in Bergen op Zoom obsolete. At this moment a driver of Nabuurs needs to physically report to the gate planning employees to get assigned to a gate. An IT solution may be introduced that will automatically assign the correct gate to the driver which will speed up the process immensely. Furthermore Partner Logistics will reduce the queues at the gate planning which will increase the efficiency.

10. Conclusion

In the logistics service provider sector the margins are getting smaller and smaller which compels logistic providers to join forces by employing integral SCM. This research has been initiated by Nabuurs in order to identify and exploit the implications of SCM in general and specifically for the frozen supply chain of Unilever of which they are part. SCM has been depicted as the management of the physical, information and financial flow from the raw materials to the customer. However the exact definition of SCM is still ambiguous and the term SCM is still widely used for business practices that do not share the integral perspective of SCM.

The measurement of performance can be identified as a crucial aspect of effective management in all companies. The performance measurement of supply chains in an integral manner is still in its infancy and therefore proved to be a very interesting research area within SCM. To investigate the implications of performance measurement in SCM the following research question has been depicted:

How can supply chain performance measurement contribute to the management of a supply chain?

The research of this research question has led to the following results:

- **The identification of a supply chain as a service.** One of the first insights that this research has put forward is the concept of identifying the supply chain as a service. This concept has a number of implications for the scientific and business area of SCM. First, services are context specific for the customer and are therefore highly customer oriented. Secondly, services cannot be stocked and need therefore be managed in a specific way to make sure that the demand can be met. Thirdly, it enables SCM researchers to use models and frameworks developed for service improvement practices as for example the SERVQUAL model used in this research.
The development of the sub-supply chain concept. As stated customer orientation is crucial for the strategic intent of the supply chain as an integral entity. However the distinction of the end customer is very ambiguous. The introduction of CODPs in SCM has resulted in the introduction of the leagile principle. In my opinion this principle is a bit too ambiguous and simple. I therefore introduced the concept of sub-supply chains. Each supply chain is divided up into a number of sub-supply chains which is comprised of a minimum of three parties, as depicted in the definition of a supply chain, including a customer. This is in line with the existence of multiple order decoupling points and the change of strategy at the transition from make-to-stock towards make-to-order principles. Using this concept each sub-supply chain may follow a different strategy in line with the customer’s expectations as the CODP depicts a transition point from one end customer to another.

Lack of strategic alignment results in inefficient supply chain performance. The biggest hurdle towards SCM and associated increase of efficiency of the supply chain as a whole is the individual focus that companies still employ. The customer orientation that should result in a supply chain wide strategy does not find its way throughout the supply chain. This was substantiated by the analysis of valuations and interviews in the business case: the expectations of the customer seemed to be clear to the points of contact however these expectations are not mapped correctly and communicated throughout the supply chain to align the strategy. This lack of strategic alignment results in performance that is not focused on increasing the perceived performance of the end-customer. The developed strategy framework was validated as an effective mean to increase strategic alignment and increase the efficiency of the discussions with the customer which has a beneficial effect on the gaps in the SERVQUAL model.

Lack of alignment between strategic intent and operational performance results in counterproductive behavior at supply chain parties. The strategic intent should be clearly translated into operational performance to retain the benefits of the strategic alignment. Performance measurement provides the supply chain manager with a tactical mean to accomplish this alignment. As long as companies are measured on aspects that are not in line with the customer’s expectations and therefore strategy of the supply chain they will maintain a counterproductive performance. The interviews and valuations of the business case substantiated this lack of alignment between strategic intent and operational performance and the importance of performance measurement on operational performance and the implications on the management of the supply chain.

SCM theory does not find its way into business practices. Logistics is still a fairly practice oriented business area and managers are often promoted based on experience rather than theoretical knowledge and therefore often lack the knowledge and tools to implement theoretical frameworks. Another aspect that became very clear from this research and interviews was the psychological aspect that is associated with SCM. One of the most crucial requirements for effective SCM is mutual trust. To effectively manage the supply chain as an integral entity the different parties of the supply chain should be willing and able to share information with the other parties to show their commitment. Only when information regarding processes, costs and other business related aspects is shared is efficient management of the supply chain possible. Parties should be able to identify the implications and benefits of SCM although these benefits may not be directly visible or only after initiation of pain and gain sharing. Therefore theoretic models and frameworks are usually not implemented.
The importance of responsibility division and management structure. The lack of clear supply chain responsibilities results in a lack of management and failing supply chain initiatives. Based upon this research and interviews it can be concluded that the structure in which a team comprised of employees of the different supply chain parties is favored over other structures. This consortium enables big amounts of knowledge to be shared and has a strong support base at each company. Furthermore it shows a sign of trust and commitment to SCM and each other which will have a beneficial effect on the communication between the consortium members and the development and implementation of supply chain initiatives. This redesign is broadly applicable to almost every supply chain as measurement will lead to behavior in every business practice.

These results have led to an improvement to the definition of supply chain management that has been researched and depicted in the literature study that has been executed prior to this master thesis.

“Management, planning, and development of inter- and intra-organizational processes and information and financial flows aimed at coordination and collaboration between (sub)supply chain partners to fulfill the (sub)supply chain’s end-customer expectations as efficient as possible.”

Following the insights accumulated during this research, interviews and valuation the research question can be answered as following: supply chain performance measurement can play a huge role in supply chain management by providing the crucial link in strategic and operational alignment throughout the supply chain. One of the biggest obstacles of SCM is the lack of strategic alignment. The supply chain strategy framework that has been depicted in this research provides a clear communicative tool to discuss the lack of alignment in strategy. But as long as the PMS is not in line with the strategic intent companies will keep making counterproductive decisions, because measurement shapes behavior. Once the supply chain PMS is implemented and is in line with the strategic intent of the supply chain as a whole, companies will be more willing and able to exploit the implications of SCM because it has a positive influence on their performance towards the customer.

The strategic framework and associated PMS that has been developed joins an ever increasing group of scientific models. It distinguishes itself by establishing a link between scientific literature and a business environment, strategic intent and operational behavior, and finally customer’s expectations and supply chain strategy. In this way it has significant beneficial effects on the gaps identified in the SERVQUAL model resulting in a better match between customer’s expectations and perceived performance. The framework has been validated in a specific business case but the research has led to the conclusion that its applicability reaches far beyond this single supply chain towards almost every supply chain. It is developed to be able to cope with future expectations of customers regarding sustainability both in environment and society, and focuses on the long term relationship which is crucial to the area of SCM.
10.1. Research limitations

In this section a number of limitations of this research will be depicted:

- The questionnaire for the interview should have been more carefully developed to obtain a more objective validation of the framework and more respondents should be interviewed to obtain a qualitatively stronger result.
- The dimensions of the tool should have been further developed to be unambiguous.
- This performance measurement framework is solely focused on the supply chain as the service of delivering the product without taking the product in consideration. This implicates that the delivery of a cow would be equivalent to the delivery of an ice-cream.
- The framework makes users choose a strategic outcome while they may be only focused on one of the KPI’s associated with that category.
- The expectations are very customer dependent and therefore hard to make general conclusions regarding the valuation scores by the respondents.

10.2. Future research

In this section a description will be made of possible future research directions that were identified during this research.

- The concept of sub-supply chains that has been introduced in this research should be further explored. In this research the existence of this concept should be evaluated both in scientific and business environments. Furthermore its role on the integral management of supply chains should be analyzed.
- The relation between CODPs and SCM should be further investigated. Some literature is already present regarding the existence of multiple CODPs however the practical implications are not yet identified. This will most likely have a close relationship with the research into the existence and implications of sub-supply chains.
- The different performance metrics that are part of the performance measurement system should be evaluated and quantified to investigate whether the metrics can be grouped in these measurement categories and if they measure the right performance of the supply chain.
- The general applicability of this framework, associated performance measurement system, and redesign should be researched. This implicates that this framework may be used to explore other supply chains in other sectors and may be validated by other business environments.
- An empiric study needs to be developed and conducted to investigate whether the consortium structure is indeed the best structure for effective SCM.
- A research needs to be conducted to investigate whether the implementation of the developed supply chain strategic framework and associated supply chain PMS does indeed have a beneficial effect on the performance of the supply chain as a whole and the individual companies.
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List of abbreviations

SCM  Supply chain management
PMS  Performance measurement system
KPI  Key performance indicator
CSR  Corporate social responsibility
CODP  Customer order decoupling point
Appendix A: Measurement categories

Chan, Performance measurement in a supply chain (2003)

- **Cost (quantitative)**, cost is one of the most significant direct kind of measurement, because of its direct impact on the performance of a company and its ease to quantify. Costs can be divided up into distribution, manufacturing, warehouse, incentive, intangible, overhead, and sensitivity to long term costs.

- **Resources utilization (quantitative)**, the inputs to a manufacturer include raw materials, equipment and machines, human resources, energy sources, warehouse space, etc. The best performance is obtained by using all these resources in a well-organized and optimum way. Both lack and excess of resources is a waste of time and money.

- **Quality (qualitative)**, generally speaking, quality is the standard of a product which his related to the customer satisfaction level. Any late deliveries can be regarded as bad for the customer. Thus, quality is related not only to a product but also to the services provided. Therefore, all outcomes resulting in customer satisfaction are important; response time, lead time, customer satisfaction level, etc.

- **Flexibility (qualitatively)**, flexibility can be defined as the ability or the adaptability of the company to respond to diversity or change. Flexibility can be categorized by input (machine, labor), process (operation routing, material handling), output (volume, delivery, mix), and its improvement within the chain (new product, expansion).

- **Visibility (qualitatively)**, to reduce time waste and message distortion it is important to improve the quality of information transfer by having a more visible information sharing system. Visibility can be measured in both accuracy and time of the information transfer.

- **Trust (qualitatively)**, trust is the reliability and consistency between different levels of the supply chain and enhances the long-term relationship between them. It is important to keep a good relationship between the different entities in the supply chain which can be achieved by consistency and reliability.

- **Innovativeness (qualitatively)**, besides being the way for companies to distinguish themselves innovation also provides the entire supply chain with a way to be more specific and explore new areas. Innovation is divided up into product innovations and new use of technology.

Supply Chain Council, SCOR (2008)

- **Cost**, the costs associated with operating the supply chain. This includes the costs of goods sold, total supply chain management costs, value added productivity, and warranty/returns processing costs.

- **Responsiveness/time**, the velocity at which a supply chain provides products to the customer. This is measured by the order fulfillment lead times, the time between an order and the delivery of the order.

- **Reliability**, the performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.
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- **Flexibility**, the agility of a supply chain to respond to marketplace changes to gain or maintain competitive advantage. Measures include production, delivery flexibility and supply chain response time.
- **Assets**, the effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital. Measured by inventory days of supply cash-to-cash cycles, etc.

**Melnyk, et al, Outcome driven supply chains (2010)**

- **Cost**, reducing price and costs are the key objectives. This cost category is a combination of monetary costs and delivery and quality. With costs being the order winner and delivery and quality are the qualifiers.
- **Responsiveness**, the ability to change quickly in terms of volume, mix, or location as a function of changing conditions.
- **Security**, this outcome has recently garnered a lot of attention due to tainted food products from China and tainted generic drugs from India. It implies that it is the responsibility of the entire supply chain to ensure safe products to be delivered to the end customer.
- **Sustainability**, involves measurement of the environmentally responsible supply chains that eliminate waste, reduce pollution, and contribute in a positive manner to improving the quality of environment through eco-friendly processes.
- **Resilience**, ensures that the supply chain recover quickly and cost-effectively from disruptions. Disruptions can be caused by natural disasters, social factors, medical emergencies, economic setbacks, or technological failures.
- **Innovation**, in recent years the supply chain has proven its role as a source of innovation. Organizations innovation tasks have been performed not only internally but also in collaboration with supply chain partners.

**Beamon, Measuring supply chain performance, (1999)**

- **Flexibility**, is described as the ability to respond to a changing environment, and how well it reacts on uncertainty. The goal of the supply chain should be to be able to respond to change in an uncertain environment.
- **Output**, is the level of customer service. Without an acceptable output, customers will turn to other supply chains. A minimum level of output is usually specified by the customer concerning number of items, lead times, and on-time delivery.
- **Resources**, includes inventory levels, personnel requirements, equipment utilization, energy utilization but also cost measures. One general goal of the supply chain is resource minimization while meeting the supply chain’s objectives.

- **Customers**, this category is equivalent to quality and includes examples as fill rate in the case of mass production and conformance to specification in the case of built to order products.
- **Internal processes**, encompasses the efficiency of internal processes. It includes inventory levels, resource utilization and throughput.
- **Innovation**, incorporates the amount of effort and money put into the development of innovative ideas for the supply chain. It includes measurements calculating the best improver or best in class and the amount of new IT investments.
- **Finance**, work in progress may be expressed in monetary value rather than physical units. Supply chain management should increase profit, market share, and other financial metrics.

Fawcett, et al., Chapter 13: Performance measurement (2007)

- **Cost**, when competitive or economic challenges emerge the instinct of most managers is to cut costs, this is particularly true in purchasing, production and logistics which are often managed as cost centers. However this cutting cost can undermine vital capabilities and should only be driven by the external environment. Costs can be evaluated both at aggregate levels or function specific level, and percentage wise or absolute which has an influence on the metrics.
- **Customer service**, consists of making the right products available for use or purchase when they are needed, where they are needed. Service measures usually focus on issues related to availability, time, and satisfaction. Therefore this category includes all kind of fill rates but also cycle times and customer complaints.
- **Quality**, quality is at the top of the priority list of customers. Basic measures of this category look at the functionality of the product or the reliability of the service. In sourcing and production defective rates, functionality, are prominent opposed to logistics in which reliability is more prominent. This category also encompasses the availability and accuracy of information.
- **Productivity**, relates the outputs generated by an activity to the resources consumed by the activity and is usually expressed as a ratio. Measuring productivity is usually easy however comprehensiveness of these measures is more difficult. Increasing productivity may also impact other measurements as quality indirectly.
- **Asset management**, historically focused on maximizing the capacity utilization of all assets. According the theory of constraints however it is more important to focus on alleviating the bottleneck. As utilizing all assets at maximum capacity usually results in a built up of inventories. One of the most favored measures of asset utilization is return on assets.
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Lyons et. Al, Chapter 7: Supply chain performance measurement (2012)

- **Cost**, these measures include transportation and inventory costs. Using these cost measures a quantitative cost profile across the chain can be created. It is important to note that these costs are supply chain wide and should therefore be managed supply chain wide. Following this analysis a distribution over the supply chain can be made to pinpoint problems.

- **Responsiveness/time**, is associated with the flexibility of the pipeline of activities that constitute the supply chain. These activities can be mapped using a value chain which depicts all the different process steps and its associated cost and time details. The measures include forecast accuracy, supply chain cycle time, pipeline inventory, and value adding contribution.

- **Reliability**, is concerned with the service level and associated customer satisfaction that is achieved. Furthermore it concerns the disruptive effects of activities within the supply chain. The two measures used in this framework are stock-outs and backorders.

- **Behavior**, the measures under this category concern supply chain coordination and collaboration, depicting the consequences of behavior of the different entities in the supply chain. The magnitude of the bullwhip effect (demand amplification) is regarded as one of the most crucial behavioral measures.

Kaplan and Norton, Using the Balanced Scorecard as a Strategic Management System (1996)

- **Financial**, the ultimate goal of any company is to make profits. Every measure should therefore be selected to fit in the selected strategy of improving financial performance. Financial objectives therefore play a dual role, it defines the expectations to financial performance and acts as a target for improvements in the other three perspectives. The financial objectives differ between business life cycles; growth, sustain, or harvest.

- **Customer**, this perspective is focused on the customer satisfaction. If customers are not satisfied they will eventually find other parties that will meet their needs. Poor performance in this perspective is therefore a leading indicator for future decline, even though the current financial performance is up to standards. These measures are very customer specific and should be tailored to every customer.

- **Learning and growth**, includes the training of new and current employees and corporate cultural attitude towards individual and corporate improvement. With current rapid technological advances it is crucial that people, the repository of knowledge, are in a continuous leaning mode. This goes beyond training; it also incorporates elements as tutors and mentors. These factors are reflected in expenses made in these systems.

- **Internal business processes**, encompass all the processes that are executed within the direct boundaries of the focal company. Metrics in this category allow the managers to know how well their business is running. The metrics employed to measure these processes are usually created intern as processes are hard to depict by outside consultants.
Brignall and Ballantine, Performance management in service business revisited (1995)

- **Financial performance (result)**, the categories are divided up into results and determinants. Financial performance is a result of running the business and is measured in profitability, liquidity, capital structure, and market ratios.

- **Competitiveness (result)**, this measurement category is important for managers who need to select and implement a strategy to beat the competition while satisfying organizational performance. Measures include relative market share and position, sales growth, and measures of the customer base.

- **Resource utilization (determinant)**, is the first of four determining the result of a company/supply chain. It incorporates the productivity and efficiency of the executed processes.

- **Quality of service (determinant)**, is the encompassing category for all customer service indicators. These include reliability, responsiveness, comfort, friendliness, availability, security, among others.

- **Flexibility (determinant)**, this category is not well defined in the article but is solely described as a number of measures, namely: specification flexibility, volume flexibility, delivery speed flexibility.

- **Innovation (determinant)**, is the last of the four determinants and is described as the efficiency of the innovation department. It includes both the performance of the innovation process as the performance of individual products.
Appendix B: Performance metrics

Costs

Activity based costing:

A process orientation is crucial for the efficient management of a supply chain; therefore this should be reflected in the measurement of the supply chain. The mapping of a process can be enhanced to a value stream map. Value stream mapping includes the costs and time of each process in the supply chain resulting in an overall cost for each product that is serviced by the supply chain. However this does not include overhead costs and efficiency measures and solely focuses on the visible costs. Based on this lack of integrality the activity based costing was developed in which the cost of the service is the sum of all the activities required to execute the service (Neely, et al., 2005).

Using the activity based costing method supply chains employ an integral view on the costs that are associated with the operations of the supply chain and disposes the need for efficiency measures. This will result in a clear overview of where the costs are made. Furthermore it provides the supply chain manager with a supply chain wide view of the consequences of improvement projects. For example an reduction of costs on one end might result in higher costs in other parts of the supply chain. Or the reduction of costs in operations may result in higher administration costs because more paperwork needs to be checked.

Inventory costs:

Activity based costing is solely focused on value adding processes. Inventory costs are not value adding processes but are needed to maintain a degree of flexibility, quality or operational consistency. Therefore they need to be measured separately from the activity based costs. This metric should focus on both overall as individual inventory costs. Overall costs need to be minimized by the optimal positioning of stock keeping flexibility and quality in mind because increasing the inventory towards the customer will increase overall inventory costs but will also benefit flexibility and quality. Individual inventory costs should be measured to acquire information about the performance of different warehouses compared to each other.

Other overhead costs:

The combination of activity based costing and inventory costs include almost all the different cost items that can be identified in the supply chain. However they are focused on day to day operations of the supply chain, and some overhead costs cannot be assigned to a single service of the supply chain. Therefore a separate metric should be incorporated into the system to make sure that these costs are kept track of as well. Supply chain project cost is an example of a cost that is encompassed by this metric. The supply chain will undertake projects that will benefit the supply chain on the long term but these costs cannot be assigned to a single service. Especially when the project fails, and the results cannot be contributed to a specific process.

Customer quality

Customer Case Fill On Time:

The service that a supply chain delivers is the delivery of the right product at the right location on the right time. Therefore the customer case fill on time (CCFOT) is the most important measure of the supply chain. The CCFOT combines measures that are often depicted separately; on time performance, reliability, number of defective deliveries, etc. The CCFOT is a percentual metric that is usually measured on an order
basis, each order that is delivered completely without defects in the right time window at the right location scores a 100%. Every deviation on either of the aspects results in a 0%. Because of this the CCFOT metric is usually reported on a daily, weekly, or monthly basis depending on the number of orders.

The CCFOT is a good metric to have a distinct overview of the overall service performance. However because it incorporates multiple aspects of the service it is often unclear where the mistake lies in the case that an order is scored with 0%. Therefore this metric is mainly strategically oriented depicting the overall performance of the supply chain as a whole rather than measuring the performance of operational processes.

**Lead time:**

Often time metrics include set-up times, transport times, process times, etc., however customers are generally not interested in the specifics of a supply chain. The sole metric they are usually interested in is the time between the placement of an order and the delivery of the order, lead time. The optimal situation for all customers would be to have zero lead time. But shorter lead time tend to lead to higher costs as stock needs to be positioned further up the supply chain incurring higher inventory costs. Beside stock costs shorter lead times also result in less time to plan and consolidate deliveries which will result in higher logistics costs.

So customers need to make a decision between the lead time they aspire and the costs that this lead time reduction results in. The lead time that is required by the market is very context-dependent. In the case of fast moving consumer goods distribution centers usually request lead times of about a day and place an order every day. In the case of expensive electronics shops tend to focus more on cost reduction by ordering a few each time with the possibility of being out of stock. It is also dependent on the business hours of the supply chain and customers. Customers that are open 24/7 will probably require the same attitude from their supply chains. This may result in shorter lead times as orders can be placed throughout the day instead of only in business hours.

**Customer satisfaction:**

All supply chain metrics should emphasize customer satisfaction however this metric is solely focused on the perceived quality by the customer regarding support and communicative performance of the supply chain. This metric includes aspects as communicative ability, transparency, information sharing all resulting in a degree of trust. This metric is often measured using a scorecard, for example the supplier scorecard to gain insight in the performance of the supplier compared to other suppliers of the customer. A similar scorecard could be developed to measure the performance of the supply chain service compared to other supply chains. The scorecard should grasp aspects of customer complaints, query response and resolution times, information accuracy and availability, and financial handling resulting in an integral customer satisfaction with the supply chain support service.

**Flexibility**

**Operational flexibility:**

Flexibility is divided up into operational flexibility, short term, and market flexibility, long term. The operational flexibility is associated with the ability to cope with unexpected circumstances in the day to day activities of the supply chain. In the case of unexpected circumstances the performance of the supply chain is no longer incorporated by the CCFOT measure and may therefore be neglected. However customers do assign a lot of value to the ability to deliver even in these special circumstances. An example is a rush order
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placed by the customer which needs a lead time of 5 hours rather than the normal 24 hours which is still delivered to satisfaction of the customer. This order is not measured in the CCFOT but should be quantified to shows the flexibility of the supply chain. Another example could be extreme weather conditions in which the supply chain is still able to deliver. This metric could be quantified by keeping track of all the orders that are not measured in the CCFOT but are still delivered to satisfaction of the customer or by expressing it by the percentage of slack time by which the delivery time can be reduced.

**Market flexibility:**

Market flexibility encompasses the ability to cope with changes in the market. Changes in the market mainly take place in two areas: product mix and capacity. The product mix flexibility depicts the ability to cope with the introduction of a new product or mix of products that need to be transferred through the supply chain. This metric may be quantified by the amount of costs or performance changes associated with the introduction of a new product. Capacity flexibility however provides a better candidate to be quantified. Capacity flexibility can be depicted as the response time needed to response to a major change in market demands, due to seasonal effects, market changes, or promotions. The SCOR framework (Supply-Chain Council, 2008) quantifies market flexibility as the theoretical number of days required to identify a change in market demand and increase production with 20%.

**Innovativeness**

**Degree of internal innovation:**

The degree of internal innovation is an individually oriented measure however it is aimed at beneficial effects on the supply chain as a whole. Internal innovation may have spill-over effects to the processes of the supply chain partners. Furthermore it may have a beneficial effect on the continuity of the party which is beneficial for the relation with the other supply chain parties because of the long term vision of the company. This measure could be quantified by using a scorecard regarding the presence of an R&D department, number of product and process innovations, and total R&D budget and time.

**Degree of networked collaborative innovation:**

The degree of networked collaborative innovation is associated with the innovative projects undertaken by multiple parties of the supply chain. These innovations are usually related to the processes linking the different parties. Furthermore supply chain wide information technology solutions and innovative ways of information sharing throughout the supply chain can be related to this type of innovation. From a supply chain point of view this type of innovation is crucial as it increases trust and cooperation between the supply chain parties.

**Degree of customer co-creative innovation:**

Supply chains may transform the customer from a passive consumer to an active contributor. By involving the customer in the innovation process a new source of innovative ideas can be utilized. These ideas are often more in line with the service expectations and perceived service of the customer and therefore provide the supply chain with innovations that enable the supply chain to service the customer better. This involvement can be arranged in different structures; a customer could provide a R&D expert to undertake projects in cooperation with the supply chain, the customer can provide ideas for innovative projects for the supply chain, or a combination of both.
**Corporate social responsibility**

**Society:**

A company has a big influence on the direct community as on the society as a whole, providing work, safety, welfare, and sometimes even healthcare. However not all companies and therefore supply chains have identified the implications of their business on the society as a whole. Therefore clear metrics should be in place to measure the social sustainability of a supply chain, resulting in a more balanced approach of decision making. Hutchins and Sutherland (2008) depict four quantifiable metrics: labor equity, healthcare, safety, and philanthropy. However the applicability of these metrics is very environment dependent, for example healthcare which is not applicable in the Netherlands but plays a significant role in the United States. Philanthropy is rather broad applicable as it describes a supply chain’s philanthropic commitment via a ratio of charitable contributions to market capitalization. Another quantifiable measure for the Netherlands could be the percentage of handicapped employees of the company or supply chain as a whole.

**Environment:**

Reducing the ecological footprint can be roughly divided up into four focus areas: energy management, waste management, carbon management, and resource management. Energy usage is ever increasing in the current technologically advancing environment however these same technological advances should be used to reduce the energy usage by for example the use of LED and reduce ecological footprint by the use of green energy suppliers. The management of waste encompasses two factors: reduce the overall waste production, and managing the recycling of materials. Resource management has a strong economic incentive as efficient use of resources reduces the costs; however the use of specific environmental resources that can harm the environment or is scarce in the environment requires further attention.

Carbon footprint is one of the key points of current environmentally aware supply chains. There are two specific factors significantly affecting the carbon footprint across the supply chain: transport and packaging. Neither is generally controlled by a single entity but both have impacts in any product’s journey through the supply chain. It makes sense therefore to consider these as cross supply chain issues, and manage them accordingly by designing packaging and transport systems for minimum environmental impact across the whole chain. However carbon footprint reduction is often initiated from a cost perspective and therefore provides a misleading metric for the supply chain. This issue should be resolved by using multiple quantified inputs for this metric or a more general metric encompassing the budget that is available for environmental projects.
Appendix C: Interview structure

Name:
Company:
Function description:

What is your definition of supply chain management?
How is your function related to supply chain management?
Is effective supply chain management possible considering the diversity of the different members of the supply chain?
What role does a performance measurement system play in supply chain management?
How should the strategy be formulated, customer based or competence based?

Framework:
On what areas do you think that customers want to be serviced by the supply chain?

Discussion of the proposed framework.
Are there any missing aspects that should be incorporated in this framework?
Valuating of the different categories using the tool depending on user/competence.

Supply chain management business case:
Does your company work from a functional or process perspective?
Is the IT in your company capable of exploiting the implications of supply chain management?
Is the supply chain being managed at this moment?
Who should fulfill the role of supply chain manager?
Which supply chain initiatives can you identify which have not yet been explored?
Other comments or questions?
Appendix D: Interview summaries

Simon Verburg, 17-06-2013, Bergen op Zoom

Name: Simon Verburg

Company: Partner Logistics

Function: Manager operations Netherlands and Belgium

Operational responsibility for the site managers of Ieper, Bodegraven, Waalwijk, Bergen op Zoom, managing the different functions from HR to operations to investment projects. Not directly responsible for sustainability projects. Operations manager is responsible for the day to day operations while the manager operations focuses on the general processes and operations and how these can be improved.

What is your definition of supply chain management?

A supply chain is the entire process from the raw materials to the end customer and everything in between. Partner Logistics is responsible for one of the steps within the supply chain: warehousing. No supply chain management function present within the organization of Partner Logistics. Because of the consolidation of stocks of different customers Partner Logistics does aim to optimize different supply chains and reduce costs.

How does supply chain management relate to your function?

There is no direct relation except for the implementation of new processes which result from supply chain managing projects. However from the following stories it seems that he does have pivot role within the supply chain management process as he is the one who is able to identify improvement possibilities in the relation with the other parties in the supply chain on operation basis.

How may a performance measurement system contribute to the performance of the supply chain?

Currently a tariff is set and a set of KPI’s has been developed to measure the performance of Partner Logistics. The KPI’s of the transport company and the KPI’s of Partner Logistics are currently not aligned which results in a mismatch of performance when the processes meet. Transport companies are flexible and are only focused on quality, delivering the product at the right place at the right time. Partner Logistics is focused on efficiency which results in a standardized inflexible process focused on costs.

Framework:

Quality: agree upon the definition set in the framework and has no extensions.

Costs: is one of the most important factors for the customers and therefore crucial in the current market. Should be focused on costs rather than profits per company.

Flexibility: is comprised of multiple forms of flexibility. Partner Logistics employs buffers to implement some flexibility into the processes. Investments in buffers are short term flexibility on a day to day basis.

Innovation: not quite sure whether the innovation category is something the client demands from a supply chain. The customer will always focus on quality and costs rather than secondary measures. They will advocate for these secondary measures but only as long as it will yield benefits. However they might be companies that market their innovative character which might imply that they demand a certain degree of innovation, both within the supply chain as with the customer.
CSR: As with innovation it is a secondary category and customers will always focus on costs and quality. A lot of projects are executed from a cost point of view and CSR will be used as a bonus to present the results more positively. But again as with innovation their might be companies who market their corporate social responsibility and will be demanding some kind of CSR from the supply chain, but always from a cost point of view.

**Is the framework all-including?**

Cannot think of any aspects not covered by the framework.

**Is the supply chain being managed at this moment?**

Every party plays their own role in supply chain management but always to their own benefit. Therefore at this moment no proper supply chain management function can be depicted in the supply chain. Unilever does encourage projects that involve multiple parties in the supply chain but only to their own benefit as well.

**Who should fulfill the function of supply chain manager?**

Every party should play their role but every party will also aim to improve their own profits. Open communication is crucial to the success of supply chain management initiatives. However no party will give all including insights in the profit model and processes because of the competition and core competencies resulting in their business model. Therefore a third party hired by the supply chain as a whole might prove to be the solution to open communication without trust issues. A team comprised of managers of the different parties of the supply chain working together to improve the supply chain will not work because of the double agendas of all the parties.

**Other**

There are a number of KPI’s set with the different customers. Tariff is set based upon the costs of the processes. And minimum performance is set in multiple KPI’s. Differences between customers are possible as you may give a certain customer a free flexible spot they may use to their liking.
**Joop de Hoog, 26-06-2013, Haps**

**Name:** Joop de Hoog  
**Company:** Nabuurs  
**Function:** General Manager Belgium.

Joop has both commercial and operational responsibility for all the processes and functions within the Belgium environment. Daily activities are managed by the different site managers. Joop day to day activities include mostly project based activities, both preventive as corrective management of problems and improvements.

**What is your definition of supply chain management?**

“Van zand tot klant” freely translated: from dust to customer. This implicates that supply chain management includes all activities associated with the most efficient process of supplying the customer with the demanded product from the initial raw materials. According to my definition and description supply chain management does not include horizontal collaboration. This does have a positive effect on the different supply chains but is not encompassed by supply chain management.

**How does supply chain management relate to your function?**

The function of General Manager Belgium has a significant relation with supply chain management. I undertake action to initiate communication between the different parties in the supply chain to increase the supply chain efficiency. The example of pre-loading which I initiated and the introduction of transport letter scanning possibilities. Furthermore I provide Partner Logistics with information regarding projects and activities undertaken that have a direct influence on the relation between the two companies. However I encounter a lack of cooperation from the side of Unilever and Partner Logistics to this end.

**Does your company employ a functional or process view?**

Nabuurs as a group is functionally oriented. The exact processes that are employed to execute their activities have not been mapped so far. Some of the customers have been asking for such a process overview and they have been explained what processes are undertaken. However this has never been put onto paper and still resides in the heads of the employees. Therefore there is a lack of standardization of processes which has a negative influence on the supply chain as a whole.

**Is the IT of the company prepared for the implementation of boundary spanning initiatives?**

There is no standard IT solution in place for the standardized processes within Nabuurs. This is in line with the lack of a process mapping which is needed to make a fitting IT solution. The business case Heyen is a case in which there is integral communication with the other parties in the supply chain resulting in a boundary spanning IT solution. But so far these initiatives have been an exception on the rule. A standardized IT solution should be in place within Nabuurs and customer specific solutions need to be implemented to communicate with the IT software of the customers.

**Framework:**

**What categories of performance measurement do you think a customer wants to exert influence upon?**
Initially only the categories Quality and Flexibility are included. However it may be extended to also include costs as tariffs are made upon the costs associated with the delivered quality and flexibility performance.

**Quality:** is one of the key performance indicators including CCFOT as one of the most prominent factors and lead time and communication as secondary but important factors. For example the use of Polish truck drivers for national freight. This is cost effective but reduces the customer satisfaction. Therefore quality should indeed include three performance indicators: CCFOT, leadtime, and customer satisfaction.

**Costs:** are currently mainly internally focused but are strongly related to the processes that are undertaken to fulfill a certain order. Therefore Nabuurs should be able to provide clear process costs to be incorporated into the total supply chain costs. And I acknowledge the presence of the other two cost factors incorporated in this category.

**Flexibility:** is in my opinion the presence of leveringsgarantie, meaning guaranteeing the delivery of a certain order no matter what. This implicates a certain degree of flexibility on a day to day basis. Furthermore we have discussions with customers about the long term growth of business, implicating the presence of long term flexibility.

**Innovation:** innovation does play a role for the relation between customer and supply chain. As customers identify the implications of long term relationships with logistic parties they are willing to make extra costs in the short term to improve the capabilities of the supply chain in the long term. Furthermore it has a strong relationship with CSR as a lot of innovative ideas have a beneficial impact on the environment.

**CSR:** CSR is important both from a customer point of view as from a company point of view. Customers identify the implications of CRS and want the supply chain to behave accordingly. I predict that the business environment will change to a situation in which more emphasis is laid upon social welfare which means that they want to start paying attention to this area from now on. Environment kpi’s should lay emphasis on total budget put into projects rather than pure CO2 reduction.

**Is the framework all-including?**

I think that the framework includes all important factors and I cannot think of more factors not yet included. Furthermore I value the broadness of the framework and view of this analysis.

**How may a performance measurement system contribute to the performance of the supply chain?**

As the measures are not in line with the performance, especially with Partner Logistics, a performance measurement system would definitely improve total supply chain performance. Therefore a properly set up supply chain measurement system would improve the overall supply chain performance as it will make supply chain parties focus on the end result: customer satisfaction.

**Is the supply chain being managed at this moment?**

At this moment the supply chain is not managed as a whole. I do feel the responsibility to be involved with supply chain management practices that might be employed however he feels the lack of such responsibility feeling with the other parties in the supply chain.

**Who should fulfill the function of supply chain manager and is it possible to do effectively?**

In the case of a single party fulfilling the role of supply chain manager, Partner Logistics is a crucial party. As with Nabuurs’ collaboration in Westerlo, a cooperation might be employed in which Partner Logistics communicates with the customer and open communication is employed around the competencies, process costs, and profit model of the supply chain parties. Furthermore Unilever should
take up their responsibility to facilitate this kind of collaboration. An external party will improve collaboration even further but will increase costs. Finally a team of members of all the different parties will not work as the different parties need to be more open about their processes to do so. Therefore the supply chain cannot be effectively managed at this moment.

**Other**

Environment measures should strive further than just CO2 reduction and should involve all time and budget that is employed to improve the effect on the environment. Unilever is focused mainly on flexibility and quality rather than costs.
Tonnie Bracke, 27-06-2013, Bergen op Zoom

**Name:** Tonnie Bracke

**Company:** Partner Logistics

**Function:** Site manager Bergen op Zoom.

Responsibility for all the day to day activities of the site Bergen op Zoom, managing around 100 employees from operations managers to forklift drivers. He is responsible for developing and reporting KPI’s, both internally to the customer as externally to the customer.

**What is your definition of supply chain management?**

The supply chain is defined as following: from ground to product to delivery to the end customer. Supply chain management is dependent on the area that the person has an influence on. Therefore the scope is usually focused on the focal company resulting in internal performance. If it cuts across boundaries it usually only encompasses the direct suppliers and customers of the focal company.

**How does supply chain management relate to your function?**

Because of my responsibility for the day to day activities, I manage the internal process as a whole. Therefore my function relates closely to the execution of the processes identified by higher management that might improve supply chain performance. I am also in charge of the different processes that are executed and this enables him to identify possible supply chain initiatives which would improve supply chain performance. However because of the current lack of an operations manager, we lack the time to effectively manage the development and implementation of these initiatives.

**Does your company employ a functional or process view?**

Partner Logistics is clearly process oriented from an operational point of view. The entire process consists of the three simple steps: inbound, inventory, and outbound, and responsibility and functions are divided accordingly. Process mapping has been done but has never yielded a clear structure of the process that is undertaken deeper than the three processes identified above.

**Is the IT of the company prepared for the implementation of boundary spanning initiatives?**

Yes, the software is being upgraded and theoretically the IT can be further developed to be able to cope with extensive supply chain management.
**Framework:**

**What categories of performance measurement do you think a customer wants to exert influence upon?**

The main focus of customers lies on quality and costs. The customer wants to receive the right products at the right place at the right time, against the lowest price.

- **Quality:** Is the most important factor and is described correctly with the KPI’s right product right place, and right time.

- **Costs:** is crucial from a customer perspective. Total supply chain costs have a direct influence on the tariff set for the end customer. Furthermore inventory costs are mainly made at Partner Logistics so they should be measured from this perspective as well.

- **Flexibility:** Partner Logistics is very flexible and this is one of the core competences of Partner Logistics Bergen op Zoom. Bergen op Zoom is productive 24 hours/365 days a year which makes them very flexible. Which should be reflected in a framework.

- **Innovation:** Partner Logistics has lost focus on innovation in the recent year because they were focused on improving the quality and costs of the organization to meet standards. They now however start to pick up with new technologies to further increase their productivity. Therefore innovation is one of the key indicators for the long term.

- **CSR:** CSR is often said to be part of the demands however it does not translate into actual demands when costs are involved.

*Is the framework all-including?*

The main focus lies on quality and costs and the other measures are secondary. The other measures are maybe even redundant.

*Should the strategy be customer oriented or competence based?*

Initially companies should focus on providing a certain standard on the different measurement categories, especially quality and costs. From then on it depends on whether you go towards the market or let the market come to you. In a relationship the main focus should be on meeting the expectations of the customer and therefore the performance should be measured accordingly.

*How may a performance measurement system contribute to the performance of the supply chain?*

Measuring the right things is at the basis of a good performance for the supply chain as a whole, implicating that a supply chain performance measurement system employed throughout the supply chain will make companies more supply chain oriented rather than internally.

*Is the supply chain being managed at this moment?*

The power lays with the client, in this case Unilever. They have and employ the authority and means they possess to enforce supply chain collaboration. However this is not the way in which effective supply chain management is undertaken.

*Who should fulfill the function of supply chain manager and is it possible to do effectively?*

As said before Unilever possess the power to control the entire supply chain and should therefore adopt the role of supply chain manager. However they do this from an authority point of view which hinders the supply chain thinking of the underlying parties. A team comprised of the different parties will
work best as it improves trust. External party would not work as the parties would not be willing to share information and the external party does not have the knowledge required. Furthermore Partner Logistics cannot fulfill the role of supply chain manager either.
Peter Bryssinck, 27-06-2013, Bergen op Zoom

Name: Peter Bryssinck

Company: Partner Logistics

Function: Hoofd Bedrijfsbureau, Manager supporting departments.

Responsible for the daily activities that are needed for the internal operations: planning, administration, operations supporting services. Also execute some of the operations manager activities as that function is currently vacant. This function is the main link between the internal operations and the external parties.

What is your definition of supply chain management?

Supply chain management is the management of the links between the different parties in the supply chain.

How does supply chain management relate to your function?

Strong relation between my function and supply chain management as I am the operational manager of the link between Partner Logistics and all the transporting companies both inbound and outbound. Therefore I act as a spider in a web of links. I am in charge of the operational side of these links and Simon on the strategic side of supply chain management from Partner Logistics perspective.

Does your company employ a functional or process view?

Partner Logistics has a distinct process view. The organogram can be build up from the processes up. For the processes that link Partner Logistics with other parties in the supply chain the responsibility lies with me while Tonny is responsible for all the internal processes.

Is the IT of the company prepared for the implementation of boundary spanning initiatives?

The IT of Partner Logistics is very internally focused. This means that there is no real time communication between the IT solutions of Partner Logistics and other parties and it is not possible for customers to gain insight in the current state of their product within Partner Logistics.

Is effective supply chain management possible considering the diversity of the different members of the supply chain?

Efficient supply chain management is certainly possible but Partner Logistics is not capable yet, both because of the internal focus and the fear of competition. It should be built up from the relation, so first the relation has to be built to gain mutual trust before trying to integrate processes and practices.

How should the strategy be formulated, customer based or competence based?

The strategy should always be set up from the perceived expectations from the customer. Therefore the supply chain as a service should follow the strategy that is in line with the demands of the customer.
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

Framework:

On what areas do you think that customers want to be serviced by the supply chain?

The customer is interested in the flexibility, quality, and cost of the supply chain. Flexibility can be described as the ability to respond to unexpected circumstances. Quality is the CCFOT measure. And costs is the tariff compared to competitors.

Discussion of the proposed framework.

Quality: mainly depicted by the CCFOT measure, delivering the right package at the right time at the right place. But other factors as customer communication satisfaction are also important but rather qualitative than quantitative as other measures.

Costs: in the cost factor the main focus should lie on process costs because these are an important indicator for the efficiency of the processes. Furthermore overhead costs should always be as low as possible which is done by attracting people based upon processes rather than functions.

Flexibility: flexibility encompasses short term operation flexibility and long term capacity flexibility. Customers assign value to both of these factors.

Innovation: I am not convinced by the value of this category. It is mostly an image booster rather than an order winner. Innovation is mainly seen as cost rather than profit enabler.

CSR: as with innovation it is more of an image booster and therefore a proper cost and profit assessment should be made. If a company makes any effort towards taking their social responsibility it is because the customer initiates, in line with the customer orientation a supply chain should retain.

Are there any missing aspects that should be incorporated in this framework?

Framework is all including, but the importance of categories innovation and CSR are not visible in the operational side of business.

Would this framework provide a basis for efficient supply chain management?

This framework and its associated measures should provide the operational side with a clearer view of the performance of the company. This results in a better communication towards commercial departments and customers.
Supply chain management business case

Is the supply chain being managed at this moment?
At this moment there is no clear supply chain management visible. There are supply chain initiatives which indicate that there are employees that retain a supply chain vision however there is no clear responsibility or function present in the supply chain.

Who should fulfill the role of supply chain manager?
A supply chain manager from single company would most certainly result in inefficient initiatives because of double agendas and the evasive attitude towards sharing information and profit models. An external party would decrease this lack of trust but would not be able to make efficient decisions because of a lack of support from the employees of the different companies. Therefore a team or forum comprised of the different companies would result in the most effective supply chain management. It has sufficient support and the consequences of double agendas can be reduced.

Other comments or questions?
Supply chain management wins or fails with relation management. As stated before trust is crucial to make collaborative decisions and therefore the relation should be carefully managed, both with customers as with other parties in the supply chain. Furthermore the development of IT solutions should gain extra attention because there lies a future in communication and transparency which is crucial to supply chain management.
**Eelco Schnabel, 01-07-2013, Bergen op Zoom**

**Name:** Eelco Schnabel  
**Company:** Partner Logistics  
**Function:** Commercial Director

Eelco is responsible for first contact with the client and market orientation. Furthermore he takes care of the financial agreements with the different clients. Is not the first point of contact when problems arise but will be escalated upon when the client has long lasting complaints. So he is also responsible for maintaining a good relationship with the client.

**What is your definition of supply chain management?**

The supply chain encompasses the physical flows of materials from the raw materials to the end customer. Therefore supply chain management is the management of all the different links between the different chains within the total supply chain. Information and communication flows are secondary supporting activities and are not focus points of supply chain management. Supply chains are vertical in the sense that it encompasses the flow of one product throughout different organizations. Therefore horizontal supply chains do not exist.

**How does supply chain management relate to your function?**

I am responsible for the first contact with the surrounding suppliers and customers however the initiatives are mainly initiated and executed by the operational end of the organization. And for the translation from customer expectations to the operational performance and therefore do play an important role in performance measurement translation.

**Does your company employ a functional or process view?**

Partner Logistics is mainly functionally organized. There has been a project called “our process” in which the process has been mapped and the operations are focused around the core value adding activities however the organization is functionally oriented, even on the operational side of the organization. Multiple disciplines as operations, drivers, planners, and technical support as functions are present which are maintained and organized from a functional perspective rather than a process view.

**Is the IT of the company prepared for the implementation of boundary spanning initiatives?**

At this point the IT solutions employed by Partner Logistics are internally focused. The mainframe consists of a Warehouse Management System which is not able to communicate or incorporate external information flows. Therefore it does not provide a good basis for supply chain initiatives in which knowledge and information sharing is important.
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

Framework:

What categories of performance measurement do you think a customer wants to exert influence upon?

There are three primary categories of measures; quality, responsiveness, and costs.

Quality: quality is the second most important factor of performance measurement. It includes measures relating to sustainability regarding food safety and performance delivered to the end customer. CCFOT does include these measures when broadly defined. Lead time is both part of quality towards the customer and flexibility because of the 24/7 philosophy of Partner Logistics.

Costs: is the most important aspect of performance measurement. It includes efficiency factors, total cost of ownership and unit costs. The use of process costing to efficiently display the cost configuration of the supply chain is a good idea. However customers usually should not have insight into the cost model, let alone have an influence on them. This is the responsibility of the individual company.

Flexibility: this category is depicted as responsiveness however the description is similar to the description of the flexibility category used in the framework. Flexibility can be depicted in two different categories. The first one is aimed at the day to day activity flexibility, or the operational flexibility. This includes the switch from two freights today to 10 freights tomorrow and disruptions in timing of freights, the result of delays or defects. The second one is the market flexibility, the ability to follow market fluctuations, technological improvements, and product differentiation.

CSR: this category has a strong relation with costs. A lot of companies will promote activities resulting cost savings as green initiatives to improve the company’s image. Therefore this category can be seen as a secondary category and does not deserve as much credit as do the earlier three categories. It is however context dependent as some companies might use this as a unique selling point.

Innovation: as the CSR category the innovation category is also secondary. It is a means to deliver better performance on the other categories rather than a goal of a supply chain. No one innovates to innovate, rather they innovate to reduce costs or increase quality.

Is the framework all-including?

As I said before I think there are only three categories (quality, flexibility, and costs) and the framework is therefore all including and should even exclude the two secondary categories, CSR and innovation.

Should the strategy be customer oriented or competence based?

It should always be a mix of the two. As a commercial person you always aim to match client’s expectations with the core competences of the company. It however does differ between the states in which the party is involved in the supply chain. In a present supply chain the focus should lie on conforming to the demands of the customer as much as possible. However the focus should mainly lie on the performance on the core competencies of a company.

Is the supply chain being managed at this moment?

The supply chain is currently being managed by the use of KPI’s set up by Unilever, who is hierarchic responsible for managing the supply chain as a whole. These KPI’s are mainly strategically oriented. In the operations the role of Unilever as supply chain manager is rather ambiguous. It is not clear whether Unilever wants to employ the role of supply chain manager or not.
Who should fulfill the function of supply chain manager and is it possible to do effectively?

The supply chain should not be managed by an independent party, because employees from an individual company will always put their own agenda in front of others. However the external party should be well acquainted with the different parties and processes. Therefore the use of a consortium consisting of different employees of the different parties in the supply chain should be the best solution. However this team of employees should be independent of the result of their respective parties to maintain a clear overall view upon the supply chain.

How may a performance measurement system contribute to the performance of the supply chain?

There is a lot of potential in the performance measurement framework and the associated tool. It provides the user with a clear overview on where the gaps lie and decrease them. In the first step the tool might just be used as communication means with the customer regarding the performance and strategy of the customer and the company/supply chain. Later on it may be implemented to provide an integral performance measurement system for the supply chain as a whole.

Other

Supply chain initiatives should initially be focused on the organization of supply chain management rather than the operational implementations of initiatives.
Jannie van Andel, 02-07-2013, Rotterdam

**Name:** Jannie van Andel

**Company:** Unilever

**Function:** Supply chain manager, business unit developer Unilever.

**What is your definition of supply chain management?**

Supply chain management is currently in the transition from being a very research oriented subject to a business subject. There has been a lot of research and there have been a lot of frameworks developed however the business environment lacks the knowledge and tools to implement the frameworks in the business. I usually define supply chain management in cooperation with supply chain marketing. Supply chain management can only work if carefully marketed to the customers to make them see the extra value of supply chain management. This value management is crucial for both collaboration perspectives as for the customers.

**Framework:**

**What categories of performance measurement do you think a customer wants to exert influence upon?**

Unilever employs the so called three C’s rule which they use to discuss the demands from the customer and the abilities of Unilever as a supply chain manager. The three C’s encompass: carbon, costs, and customer service. These are in line with the three aspects of the supply chain a customer is mainly focused upon: wrong deliver, late delivery, and their own margin. Sustainability is upcoming. Furthermore the different categories of the developed framework have been discussed.

**Quality:** I agree with the stated definition and kpi’s of the category quality. They are in line with the KPI’s no and late delivery encompassed by the CCFOT measure in the framework.

**Costs:** the costs of the total supply chain need to be managed carefully, as the customer is mainly concerned with their margin. Therefore a lower cost results in a better margin for the customer.

**Flexibility:** flexibility can be seen as the counterpart of costs. Flexibility is a twofold between short term and long term flexibility but there might be a third aspect in which customer are interested, taking care of the entire logistics side of the customer providing a total solution.

**Innovation:** innovation is at least one of the aspects that are worth discussing with your customer. However it is context dependent whether it is a goal or a means to perform on the other goals. Some companies have a clear idea about a new service/supply chain that they want to set up in which innovation may play a significant role. Furthermore there is a link between innovation and the long term relational view of the customer with the supply chain.

**CSR:** is becoming one of the crucial aspects on which companies are being measured however it is going slow. It is not a choice to follow the trend of CSR, but a must because of the changing demands of the customers. They no longer close their eyes for consequences further up the supply chain. Therefore CSR should both include society and environment aspects and should not only be focused on carbon reduction but a more general budget measure.

**Is the framework all-including?**

Yes, I cannot think of any more additions.
**Should the strategy be customer oriented or competence based?**

As stated earlier the most important aspect of supply chain management and every other practice is value creation. This can be value for the different parties of the supply chain in a cost reduction or an increased value at the customer side of the supply chain.

**How may a performance measurement system contribute to the performance of the supply chain?**

Measurement is crucial for business performance. Performance measurement is needed to assess current performance and assess project performance expectations and actual performance improvement. Therefore a clear performance measurement system would benefit the supply chain in total as also individual companies. The size of the company is important for the need for performance measurement.

**Is the supply chain being managed at this moment?**

The supply chain is managed only partially. The supply chain is managed from a country perspective. However the supply chain crosses the countries boundaries. These managers do talk to each other however not as much as is necessary to provide a good basis for broad supply chain management. The managers do get the time and money to initiate and get involved in supply chain initiatives.

**Who should fulfill the function of supply chain manager and is it possible to do effectively?**

Partner Logistics plays a crucial role within the supply chain as it consolidates a lot of the different physical and information flows of Unilever. Therefore they should be a good candidate to fulfill the role of supply chain manager. However Unilever is a good candidate as well. Unilever has the expertise and power as overlooking party. She furthermore states that the process knowledge of the different parties is crucial for the success of supply chain management. Therefore a team comprised of the different parties should be the best solution.

**Other**

Trust is a big issue in logistics. As the entry boundaries are very low, companies are very reluctant to open up their business model and processes to a possible competitor. This is the result of a lack of trust and long term relational view of the different parties.
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

Erik-Jan Helderop, 10-07-2013, Rotterdam

Name: Erik-Jan Helderop
Company: Unilever
Function description: Customer service and logistics manager

Responsible for the interaction with the B1 team customers from the customer service view. The planning and forecast of promotional articles. Management of logistics of the chilled and frozen sector focused on the outbound part of the supply chain behind the customer order decoupling point.

What is your definition of supply chain management?
Supply chain management is the control of all the processes from the procurement of the factories to the warehouse of the customer. Includes all flows, physical, information and financial. Information might even be one of the most important flows of supply chain management.

How is your function related to supply chain management?
From the customer service perspective the link with supply chain management lies in communicating the demands of the customer throughout the supply chain. After a forecast is made the entire supply chain need to be informed and managed to be able to cope with this forecast of promotional articles. From the logistics perspective the link lies in the fact that communication takes place with all the different parties of the outbound supply chain. This includes the analysis of current and future performance as well as projects to increase performance.

Is effective supply chain management possible considering the diversity of the different members of the supply chain?
Efficient supply chain management is possible as long as the different parties do not pose competitive risks towards the other parties. This means that parties that are clearly operating indifferent parts of the supply chain are more willing to share information with each other. Therefore trust is of the upmost importance for efficient supply chain management.

What role does a performance measurement system play in supply chain management?
Performance measurement is crucial for all businesses and therefore also for the supply chain as a whole. Externally the focus is significantly skewed towards quality while internally the focus is skewed towards cost reduction. Therefore an integral performance measurement system would provide benefits towards the management of the supply chain.

How should the strategy be formulated, customer based or competence based?
The strategy should be customer oriented. Customers are in power and can demand things without big consequences. This is because the customer brings money into the supply chain. Unilever does have some visions that are initiated from within Unilever without any customer incentives as for example reducing the environmental foot print.
The effects of supply chain performance measurement
Nabuurs, Partner logistics, Unilever

Framework:

On what areas do you think that customers want to be serviced by the supply chain?

The customer of the supply chain is solely focused on service. This is depicted by the on time delivery of the right goods. Furthermore they want shorter lead times and more flexibility.

Discussion of the proposed framework.

Quality: this category includes two of the measures that were initially mentioned and is therefore the most crucial one. The incorporation of communication is indeed correct however is difficult to measure.

Costs: costs is an interesting category as Unilever is not very good at discussion with customers concerning costs. This discussion might be facilitated when a clear overview can be made of the supply chain costs however the introduction of activity based costing is arbitrary. The enormous base of different models shows that there is not an easy way to map costs, let alone assign the overhead costs made by Unilever to the different products.

Flexibility: is stated to be one of the customer’s main factors and should therefore be carefully measured. However these measures might also be incorporated into quality.

Innovation: Unilever does initiate conversation with customers to come up with new ideas for Unilever. However this might as well be incorporated under quality.

CSR: customers do start to assign more value towards environmental consequences however it does not play any role in the conversation with the customer yet. This measurement category can be depicted more as a qualifier rather than a winner. This means that customers do not accept misbehavior however making the extra mile may not yield any consequences. It is primarily initiated from within Unilever.

Are there any missing aspects that should be incorporated in this framework?

The framework includes all aspects of importance however the main focus of the customer will always be in the service.

Would this framework provide a basis for efficient supply chain management?

The role of communication to close the gap between the expectations of the customer and the perceived expectations by the management is a low boundary implementation which will positively influence the communication. Furthermore the implementation of an integral performance measurement system might increase the willingness for supply chain management, however the world of retail is tough and may therefore hinder initiatives because of the costs involved.
**Supply chain management business case**

**Is the supply chain being managed at this moment?**

The supply chain is currently managed however not in an integral way. I am responsible for the correct execution of the contracts made with the different parties in the supply chain and furthermore responsible for the operational side of (supply chain) projects that are initiated from the USCC, for example the stacking of products to increase container utilization. Finally I initiate and facilitate supply chain projects as for example the pre-loading project which was a collaboration between Nabuurs, Partner Logistics, FarmTrans, and Unilever.

**Who should fulfill the role of supply chain manager?**

The supply chain controller should take up the responsibility of integral management of the supply chain. In this case that would be Unilever as they are the overviewing company. However an external party would be a better solution as supply chain management from Unilever point of view would always have a double agenda in favor of Unilever. This double agenda is the biggest barrier in supply chain management. The different companies should step out of the shadow and be open about their processes and profits. Until this moment every company will act in their own favor resulting in sub-optimization.

**Other comments or questions?**

The correct pain and gain framework is crucial for supply chain projects. Research and empirical studies should provide basis for conclusions whether this framework should be set prior to the implementation of projects or whether it should be done during the operation when the actual results become clear. This pain and gain framework also has its influence on horizontal collaboration. Furthermore horizontal collaboration should also incorporate psychological factors, supplying a Jumbo supermarket with an Albert Heijn trailer will never happen.
Jose Marques da Silva, 11-07-2013, Westerlo

Name: Jose Marques da Silva

Company: Unilever

Function description: Customer service and logistics manager Belgium

There are three customer service and logistics managers in Belgium. Each is responsible for a part of the customers, resulting in one clear person to communicate with. This is for example talking about the performance on the KPI’s but is very dependent on the type of client. Each manager is also responsible for one sector of the logistics, in my case: chilled, ice, and beverages. Furthermore each manager has the responsibility for one site associated with the sector, Partner Logistics in my case. Finally I have the responsibility of the efficient functioning of my team

What is your definition of supply chain management?

A supply chain is a service that essentially only delivers products from point A to point B, so supply chain management is the management of this service. Logistics and order management is part of supply chain management. This also includes the management of management of information and financial flows within this chain of parties.

How is your function related to supply chain management?

From the customer service perspective the link with supply chain management lies in communicating the demands of the customer throughout the supply chain. From the logistics perspective the link lies in the fact that communication takes place with all the different parties of the outbound supply chain. This includes the analysis of current and future performance as well as projects to increase performance. And because of the small margins it is important to look for new projects and initiatives to exploit supply chain management implications. It also includes the translation of customer language into strategic decisions and operational actions.

Is effective supply chain management possible considering the diversity of the different members of the supply chain?

Efficient supply chain management is possible if all the parties have supply chain orientation, see the implications of supply chain management and are willing to spend time and effort. Furthermore trust is a big issue in supply chain management.

What role does a performance measurement system play in supply chain management?

Performance measurement plays a big role in supply chain management. It makes sure that everyone is looking into the same direction and has the same objective: meeting the customer’s expectations.
How should the strategy be formulated, customer based or competence based?

The customer is leading as you need to compete for orders from the different customers. However the KPI’s that are in place do not always conform to the demands of the customer. This implicates that there is a combination of the two with a tendency towards customer orientation. For example the re-organization that is taking place at Unilever at the moment is due to discussions with customers and their demands making the organization more customers oriented.

Framework:

On what areas do you think that customers want to be serviced by the supply chain?

Customer is not really interested in the workings of the supply chain, only the end result. This end result is the delivery of the right product at the right time. Furthermore it includes the communication with the customer regarding problems and opportunities. And if the service is good costs come into play.

Discussion of the proposed framework.

Quality: The perception of quality is really difficult it may include measures of flexibility and innovation but may also be solely focused on customer service aspects.

Costs: Because the power lies with the customer, Unilever finds it hard to speak about costs and profits with the customer, except when it is in the customer’s advantage. However a good overview of the costs would be beneficial for this communication regarding costs.

Flexibility: the quality measure CCFOT does not include flexibility. The day before a rush order came in around 11:00 and was delivered at 17:00. This was a big proof of flexibility and should be measured separately.

Innovation: Innovation is hugely customer dependent. Some customers do assign value to a long term relationship and are therefore more willing to spend money and effort in collaborative innovation, while other customers see innovation solely as a cost.

CSR: customers hardly ever initiate conversation regarding corporate social responsibilities. However they do see the implications the effect of neglecting their CSR on their image. CSR can be said to be more of a qualifier rather than a winner.

Are there any missing aspects that should be incorporated in this framework?

The framework includes all aspects of importance however the main focus of the customer will remain quality. And might be more relevant to assign order qualifiers and order winners.

Would this framework provide a basis for efficient supply chain management?

This framework would most certainly have a beneficial effect on the gaps of the SERVQUAL model which will result in a better service. The supply chain is the service and therefore this framework would benefit supply chain management.
Supply chain management business case

Is the supply chain being managed at this moment?

The supply chain is currently partly managed. There are some initiatives as for example the collaboration between the logistics towards the customer’s distribution center and from the distribution center to the supermarkets. After the re-organization the organization will be more customer-oriented which facilitate better supply chain management. I will be responsible for the communication between the customer and the supply chain. That means that I will translate the demands into strategies for the supply chain.

Who should fulfill the role of supply chain manager?

At this moment Unilever takes up this role as they communicate with the factories and the customers and assign tenders for the processes in between. However after the initial tender not much effort is put into the supply chain to initiate supply chain projects. A team structure would be the best solution because of the link and knowledge with the individual companies, supply chain management is more about teamwork than anything else. However the risk remains that people employ double agenda’s. An external party would reduce this risk but will increase costs and will decrease efficiency. Unilever might employ this role as supply chain manager.

Other comments or questions?

Unilever is currently busy with a global scorecard query. This query asks the customers of Unilever what they find good and bad about the service delivered by Unilever. And it has a lot in common with the framework proposed by this report. It combines multiple levels and multiple categories to explore the demands of the customer more clearly.
Tjebbe Nabuurs, 26-07-2013, Haps

**Name:** Tjebbe Nabuurs

**Company:** Nabuurs

**Function description:** Operational manager

As operational manager I am responsible for the operational management of the numerous sites of Nabuurs. Undertake improvement projects on operational performance. Point of contact for some important customers and in case of scaled up problems. Although the title is operational manager the focus lies on strategic and tactical decision making.

**What is your definition of supply chain management?**

Supply chain management is the control and management of logistical flows from the raw materials to the customer and all the processes in between. This includes all the different flows including information and financial flows. In the case of the integral management of the supply chain the information flow is perhaps even more important. Supply chain management also includes activities as forecasting.

**How is your function related to supply chain management?**

As operational manager I am involved in the implementation of existing supply chain management practices and the development of new supply chain management concepts. The recruitment of interns to research supply chain management practices at Nabuurs is an example.

**Is effective supply chain management possible considering the diversity of the different members of the supply chain?**

Effectiveness is hard to define, but you can divide management in high and low end management. Low end management can be for example the sharing of forecast information of the client throughout the supply chain. Therefore effective supply chain management is possible however high end integral management is still far away.

**What role does a performance measurement system play in supply chain management?**

The measurement of performance increases the insight in the performance which makes companies aware of their performance which in turn will increase the performance of the company and supply chain as a whole. Therefore performance measurement may be a strong tool in the management of a supply chain. The optimal situation would be to develop the KPI’s in collaboration with the customer. However often customers have their own set of KPI’s which need to be followed. The number of KPI’s is furthermore of big importance as a big set of KPI’s results in incomprehensiveness and a small set results in a lack of insights. Furthermore KPI’s only tell a part of the story as perception is a big factor as well. The late delivery of a specific order may be very important which may result in unsatisfied customers while the CCFOT is still maintained.
How should the strategy be formulated, customer based or competence based?

The strategy should be strongly focused on the expectations of the customer. As a service provider you need to develop your company in such a way that it suits the demands of the customers. The development of competences only results in costs as it does not translate into perceived performance. Furthermore the customer starts to gain interest in the presence of integral reasoning which reflects an interest in supply chain management.

Framework:

On what areas do you think that customers want to be serviced by the supply chain?

Customers are interested in a number of factors but are mainly focused on costs, quality of delivery, sustainability, and transparency and communication. But the importance of each factor differs depending on the state of the relationship. Furthermore it is important that metrics may be deceiving as the perceived quality can be influenced by other factors for example a very important order. If this single order is not delivered correctly the perceived service is bad however all the metrics are still good.

Discussion of the proposed framework.

Quality: quality metrics are depicted in the service level agreements that are set during the tender phase of the service. This includes the CCFOT levels but also measures of lead time and communication towards the customer.

Costs: it is crucial to be open regarding costs made in the supply chain because transparency in costs results in a more open discussion regarding activities that are undertaken throughout the supply chain. Furthermore the use of process costing using activity based costing is very useful as it gives a much clearer view on the activities and processes that are undertaken.

Flexibility: flexibility should be measured separately from quality. However the ability to respond to unexpected circumstances is hard to quantify and measure exactly because of this precarious nature.

Innovation: is certainly something that customers request from a supply chain that is interested in the long term service. Because innovation requires investments it should be closely related to the contract period.

CSR: corporate social responsibility has a strong link with costs in our business. Customers are not interested in the corporate social responsibility supply chains feel as long as they do not benefit from it. Therefore cost reductions are often used as reason to be more sustainable instead of the other way around as customers do want the supply chain to be green but do not want more costs. But it is very dependent on the type of customer.

Are there any missing aspects that should be incorporated in this framework?

The framework is especially useful in existing relationships. During tenders there is a different assignment of priorities; cost and quality requirements are set once you are able to achieve these requirements then you can distinguish yourself using other aspects as sustainability and flexibility. This framework includes all the aspects that are part of the discussions with the customers.

Supply chain management business case

Does your company employ a functional or process view?
Nabuurs as a group is functionally oriented but on the operation side of Nabuurs there is a clear process orientation. The processes that need to be executed for a customer are carefully mapped and costs are assigned to the different processes which results in a clear tariff for the customer.

**Is the IT of the company prepared for the implementation of boundary spanning initiatives?**

At this point the IT solutions employed by Nabuurs are internally focused. Therefore improvements may be made to identify and retain the implications that are possible with IT solutions. Investments in IT integral solutions however are very valuable and should be carefully considered.

**Is the supply chain being managed at this moment?**

It is not managed enough at this moment, there are a lot of improvement possibilities and that is also the reason that this research is being executed. One of the reasons of the lack of supply chain management is that there is no clear division of responsibilities.

**Who should fulfill the role of supply chain manager?**

At this moment the supply chain is barely managed as an integral entity and therefore a clear structure needs to be developed in which the responsibilities for the management of the supply chain are clearly defined. An external party as supply chain manager will result in failure as they will lack the knowledge of the company and support for implementation. Putting the responsibility at a single company is better but may result in the presence of double agendas and therefore inefficient decision making. Managing the supply chain as a team is the best solution as supply chain management is dependent on collaboration.

**Other comments or questions?**

The contract duration is of big influence on the ability and willingness to work together, especially when investments need to be made. Therefore the redesign of the supply chain management structure should be closely linked with this duration of the contract to make sure that practices may be implemented and evaluated before the term is over.
Marloes Oostendorp, 26-07-2013, Haps

**Name:** Marloes Oostendorp  
**Company:** Nabuurs  
**Function description:** Business development, commercial department.

As business development employee I am one of the main contact points of customers regarding tenders and running contracts and associated performance and expectations. I am furthermore active in improvement projects that are undertaken with customers and supply chain partners to improve the efficiency.

**What is your definition of supply chain management?**

A supply chain encompasses all the processes from the sourcing of raw materials to the delivery to the end customer, which is mainly focused on the material flow. The management of this supply chain however also includes aspects of information and financial management.

**How is your function related to supply chain management?**

In my function of Business Development employee I am one of the first points of contacts of the customer and discuss the expectations of the customer. At this point I am able to distinguish the possibilities for integral management of the supply chain however because there is no (financial) relation between the different supply chain partners it is difficult to discuss boundary crossing matters. The improvement projects that are regularly undertaken do provide a good opportunity to integrate processes.

**Is effective supply chain management possible considering the diversity of the different members of the supply chain?**

Effective management of the supply chain is difficult because of the lack of transparency of the different companies. This is mainly caused by the lack of trust which is in turn caused the small margins in the market and fear for competitive actions. However I do signal a shift towards a more transparent attitude of customers and supply chain partners.

**What role does a performance measurement system play in supply chain management?**

A performance measurement system is very useful as long as its carefully developed and measures the right things in the right way. It makes communication with other departments, supply chain parties, and customers easier and clearer.

**How should the strategy be formulated, customer based or competence based?**

The strategy should be a combination of competence and customer based practices. The goal should always be to provide value adding activities for the customer. Therefore competencies need to be developed and a clear view of the expectations of the customer should be held at the same time.

**Framework:**

**On what areas do you think that customers want to be serviced by the supply chain?**

Customers are interested in a number of factors but are mainly focused on costs, customer service, and sustainability. However because of the nature of the supply chain under investigation in which Unilever provides an overarching role the costs of the supply chain do not have a direct influence on the costs for the customer after the tariff is decided upon.
Discussion of the proposed framework.

Quality: this measurement category is an equivalent to the term customer service that was mentioned. It includes the performance of the actual service that is delivered and the supporting activities as communication and transparency.

Costs: costs are of upmost importance at the tender stage of a contract. In a tender an overview is given of the service required and the budget that is associated with it. As third logistic service provider you are then expected to provide a proposition in which the expected performance is met and the associated costs for the customer including margin. After this contract is signed the price is fixed often regardless of any cost fluctuations. Customers are not very interested in open price calculations in which it becomes clear where the costs are made ad why. Furthermore transparency of costs is difficult because of the network in which companies function.

Flexibility: flexibility is mainly required by Unilever in this supply chain as they control the order process and are sometimes even responsible for the inventory levels. However it is very important where the order is initiated, if a rush order is initiated because of a problem at Unilever it is of no concern for the customer but if the customer places a last minute order which is delivered in time it does contribute to the perceived performance of the customer.

Innovation: innovation has a strong link with costs as innovations require investments and are often focused on cost reductions. Furthermore innovation is very customer dependent because of the duration of the contract and the influence on the internal processes of the customer.

CSR: the distinction between society and environment is correct as environmental projects are often closely related with cost reductions while society projects generally increase costs. In conversations with customers the topic of CSR does come up which indicate that customers are aware and interested in the CSR of the company and therefore supply chain as a whole. In tenders the CSR is often referred to as qualifier implicating that certain awareness is required to be able to compete in the tender process.

Are there any missing aspects that should be incorporated in this framework?

The framework lacks the distinction between qualifiers and order winners which is clearly made by customers in tenders. Therefore it should provide a good starting point for integral supply chain management practices in which the tender is already won and improvement projects should be considered. In this structure this framework represents all the aspects that are distinguished in conversations with customers.

Supply chain management business case

Does your company employ a functional or process view?

Nabuurs is mainly process oriented. Of course there are overhead costs which are function based but the operational side is built up from a process orientation.

Is the IT of the company prepared for the implementation of boundary spanning initiatives?

At this point the IT solutions employed by Nabuurs are mainly internally focused with only a few essential links with external systems. Some important customers do have insight in the warehouse management system of their warehouses but not on order level. Because of the agreements upon delivery times customers are not really interested in insight into the workings of the company.
**Is the supply chain being managed at this moment?**

The supply is being managed but not very extensively. The pre-loading project is an example which indicates that effort is put into boundary spanning processes to promote collaboration within the supply chain. However there is no clear division of responsibility which results in a lack of supply chain practices. The existence of double agenda’s and associated lack of trust makes for a big challenge for effective supply chain management.

**Who should fulfill the role of supply chain manager?**

Because supply chain management is a collaborative process a structure in which each supply chain party is represented in a joint venture is the best solution. This team can acquire and consolidate all the input of the different companies and are able to discuss implementation possibilities immediately because of their knowledge of the processes. The structure of a single party as supply chain manager is an alternative but is hugely demoted by the chance of double agendas and lack of process knowledge of the other companies. An external party might be beneficial because of their supply chain knowledge and mediation position in between the parties however the lack of company specific processes knowledge, higher costs, and lack of support makes for a bad solution.
Appendix E: Supply chain scope